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BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORTS.

ZOOLOGY. VOL. VIII.

CRUSTACEA.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.

Sold by B. Quaritch, Ltd., 11, Grafton Street, New Bond Street, London, W.1;
Dulau & Co., Ltd., 2, Stafford Street, London, W.1;
Oxford University Press, Warwick Square, London, E.C.4;
and at the
British Museum (Natural History), Cromwell Road, London, S.W.7.

1924–1930.

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PREFACE.

In this, the concluding volume of the zoological reports of the British Antarctic ("Terra Nova") Expedition, there is given a summary of the contents of the whole series arranged according to the zoological classification of the animals dealt with. It will be noticed that several groups of animals which might have been expected to appear in the lists have not been reported on. This is due in some instances to the fact that these groups were poorly represented in the collections obtained; in other instances to the impossibility of finding specialists who were at liberty to undertake the work of reporting on them. It is particularly regretted that Professor Garstang has found himself unable to complete more than the first two parts of the report which he had planned on the Tunicata. The collections of all such unrepresented groups, however, have been incorporated in the general collections of the Museum, and remain available for study by specialists who may at any time wish to consult them.

The unfortunate sequence of events that delayed the investigation of the penguin embryos collected by the expedition has been alluded to in the introduction to Mr. Parsons' report (Vol. IV, No. 7). Since that report was published, however, several additional embryos and a number of drawings prepared for Dr. Assheton have come to light among the effects of the late Prof. Cossar Ewart. These also have been placed among the collections of the Zoological Department, where they will be accessible to future students.

W. T. CALMAN,
Keeper of Zoology.

31*st January*, 1935.

CONTENTS.

1. TATTERSALL, W. M. Crustacea. Part VIII.—Euphausiacea.
[*Issued February* 23, 1924.]
Pp. 1–36, 2 pls.

2. GURNEY, ROBERT. Crustacea. Part IX.—Decapod Larvæ.
[*Issued November* 22, 1924.]
Pp. 37–202.

3. FARRAN, G. P. Crustacea. Part X.—Copepoda. [*Issued June* 22, 1929.]
Pp. 203–306, 4 pls.

4. BARNARD, K. H. Crustacea. Part XI.—Amphipoda. [*Issued July* 26, 1930.]
Pp. 307–454.

SUMMARY OF CONTENTS.

VOLS. I—VIII.

ZOOLOGY.

COLLECTING STATIONS. By S. F. HARMER and D. G. LILLIE.
Vol. II, pp. 1–12, 4 maps, 1914.

PROTOZOA.

Parasitic Protozoa. By H. M. WOODCOCK and O. LODGE.
Vol. VI, pp. 1–24, 3 pls., 1921.

Foraminifera. By E. HERON-ALLEN and A. EARLAND.
Vol. VI, pp. 25–268, 8 pls., 1922.

PORIFERA.

Non-Antarctic Sponges. By A. DENDY. Vol. VI, pp. 269–392, 15 pls., 1924.

Antarctic Sponges. By M. BURTON. Vol. VI, pp. 393–458, 5 pls., 1929.

COELENTERATA.

Actiniaria. By T. A. STEPHENSON. Vol. V, pp. 1–68, 6 pls., 1918.

Madreporaria. (*a*) On *Favia conferta*, Verrill, etc. By G. MATTHAI.
Vol. V, pp. 69–96, 4 pls., 1919.

Madreporaria. (*b*) Turbinolidae and Eupsammidae. By J. S. GARDINER.
Vol. V, pp. 121–130, 1 pl., 1929.

Antipatharia. By A. K. TOTTON. Vol. V, pp. 97–120, 2 pls., 1923.

Hydroida. By A. K. TOTTON. Vol. V, pp. 131–252, 3 pls., 1930.

ECHINODERMA.

Actinogonidiata. By F. J. BELL. Vol. IV, pp. 1–10, 2 pls., 1917.

Larvae. By E. W. MACBRIDE. Vol. IV, pp. 83–94, 2 pls., 1920.

WORMS.

Parasitic Worms, with a note on a Free-living Nematode. By R. T. Leiper and E. L. Atkinson. Vol. II, pp. 19–60, 5 pls., 1915.

Nemertinea. By H. A. Baylis. Vol. II, pp. 113–134, 2 pls., 1915.

Myzostomida. By C. L. Boulenger. Vol. II, pp. 135–140, 1 pl., 1916.

Hirudinea. By W. A. Harding. Vol. II, pp. 257–260, 1 pl., 1922.

Polychaeta. By W. B. Benham. Vol. VII, pp. 47–182, 6 pls., 1927.

Pelagic Polychaeta. By W. B. Benham. Vol. VII, pp. 183–201, 2 pls., 1929.

Oligochaeta. By H. A. Baylis. Vol. II, pp. 13–18, 1 pl., 1915.

Chaetognatha. By S. T. Burfield. Vol. VII, pp. 203–228, 3 maps, 1930.

BRACHIOPODA.

Brachiopoda. By J. W. Jackson. Vol. II, pp. 177–202, 1 pl., 1918.

MOLLUSCA.

Gastropoda, Prosobranchia, etc. By E. A. Smith. Vol. II, pp. 61–112, 2 pls., 1915.

Cephalopoda. By A. L. Massy. Vol. II, pp. 141–176, 1916.

Eupteropoda and Pterota. By A. L. Massy. Vol. II, pp. 203–232, 1920.

Anatomy of Pelecypoda. By R. H. Burne. Vol. II, pp. 233–256, 4 pls., 1920.

Anatomy of Gastropoda. By N. B. Eales. Vol. VII, pp. 1–46, 1923.

Nudibranchiata. By N. Hj. Odhner. Vol. VII, pp. 229–310, 3 pls., 1934.

CRUSTACEA.

Decapoda. By L. A. Borradaile. Vol. III, pp. 75–110, 1916.

Decapod Larvae. By R. Gurney. Vol. VIII, pp. 37–202, 1924.

Porcellanopagurus. By L. A. Borradaile. Vol. III, pp. 111–126, 1916.

Euphausiacea. By W. M. Tattersall. Vol. VIII, pp. 1–36, 2 pls., 1924.

Stomatopoda, etc. By W. T. Calman. Vol. III, pp. 137–162, 1917.

Ostracoda. By R. W. Barney. Vol. III, pp. 175–190, 1921.

Amphipoda. By K. H. Barnard. Vol. VIII, pp. 307–454, 1930.

Tanaidacea and Isopoda. By W. M. Tattersall. Vol. III, pp. 191–258, 11 pls., 1921.

CRUSTACEA—*continued.*

Mysidacea. By W. M. Tattersall. Vol. III, pp. 273–304, 4 pls., 1923.

Copepoda. By G. P. Farran. Vol. VIII, pp. 203–306, 4 pls., 1929.

Cirripedia. By L. A. Borradaile. Vol. III, pp. 127–136, 1916.

Cirripede Commensals. By A. K. Totton. Vol. V, pp. 97–120, 2 pls., 1923.

ARACHNIDA.

Araneae. By H. R. Hogg. Vol. III, pp. 163–174, 1918.

PYCNOGONIDA. By W. T. Calman. Vol. III, pp. 1–74, 1915.

INSECTA.

Collembola. By G. H. Carpenter. Vol. III, pp. 259–266, 1 pl., 1921.

Mallophaga. By J. Waterston. Vol. III, pp. 267–272, 1921.

PROTOCHORDATA.

Cephalodiscus. By W. G. Ridewood. Vol. IV, pp. 11–82, 5 pls. and a map, 1918.

Rhabdopleura. By J. R. Norman. Vol. IV, pp. 95–102, 1921.

Larvae of Enteropneusta. By E. W. MacBride. Vol. IV, pp. 83–94, 2 pls., 1920.

Tunicata—Doliolida. By W. Garstang. Vol. IV, pp. 195–251, 1933.

Tunicata—Copelata. By W. Garstang. Vol. IV, pp. 263–282, 1935.

FISHES.

Fishes. By C. T. Regan. Vol. I, pp. 1–54, 13 pls., 1914.

Larval and Post Larval Fishes. By C. T. Regan. Vol. I, pp. 125–156, 10 pls., 1916.

BIRDS.

Birds. By P. R. Lowe and N. B. Kinnear. Vol. IV, pp. 103–193, 16 pls., 1930.

Adélie Penguin. By G. M. Levick. Vol. I, pp. 55–84, 21 pls., 1915.

Penguin Embryos. By C. W. Parsons. Vol. IV, pp. 253–262, 2 pls., 1934.

MAMMALIA.

Cetacea. By D. G. Lillie. Vol. I, pp. 85–124, 8 pls., 1915.

8

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PART VIII.—EUPHAUSIACEA.

BY

G. M. TATTERSALL, D.Sc.,

Fellow of Trinity University College, Cardiff.

WITH TWO PLATES.

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Dulau & Co., Ltd., 32 Margaret Street, Cavendish Square, W. 1; Hamilton Kimpton, Ltd., London, E.C. 4;
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Wheldon & Wesley, Ltd., 2 Arthur Street, Holborn;
and at the
British Museum (Natural History), Cromwell Road, London, S.W. 7.

1914.

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Price Five Shillings.

British Museum (Natural History).

This is No. 3 *of* 25 *copies of "Terra Nova" Zoology, Vol. VIII., Crustacea, Part VIII., printed on Special paper.*

CRUSTACEA.

PART VIII.—EUPHAUSIACEA.

By W. M. TATTERSALL, D.Sc.

(*Professor of Zoology, University College, Cardiff.*)

WITH TWO PLATES.

PAGE

I.—Introduction 1
II.—List of Species 11
III.—List of Stations at which Specimens were obtained . . . 11
IV.—Descriptions of Species 14
V.—List of papers referred to 31
VI.—Index 34

I.—INTRODUCTION.

The collection of Euphausiacea obtained by the "Terra Nova" comprises examples of twenty-seven species which can be determined with greater or less certainty; in addition there are two or three larval forms, belonging to the genera *Thysanopoda* and *Stylocheiron*, whose specific identity is a matter of doubt.

Thanks mainly to the valuable work of Hansen, the Euphausian fauna of the world has been very thoroughly investigated, and it is hardly a matter of surprise that the "Terra Nova" collection contains no new species. The material, however, includes some interesting larvæ, the study of which has enabled me to clear up one or two doubtful points in the nomenclature of the group and to refer to its adult form an unusual larva described by Sars in the "Challenger" report.

The Euphausians in this collection were provided entirely by the tow-nettings and other plankton gatherings, made mainly at the surface and in the upper waters; to this fact must be attributed the deficiency of species of the genera *Thysanopoda*,

Bentheuphausia, *Nematoscelis*, and *Nematobrachion*, which are mainly mesoplanktonic and bathypelagic.

Some general notes on the collection are more conveniently given under the headings of the three main areas in which the collection was made, namely: Atlantic Ocean, north of New Zealand, and Antarctic and sub-Antarctic regions.

My thanks are tendered to the authorities of the British Museum for entrusting this collection to me for examination and report. As before, I am indebted to my wife for the drawings which illustrate this paper.

ATLANTIC OCEAN.

The "Terra Nova" made collections of plankton with various kinds of tow-nets at 62 stations in the Atlantic Ocean. None of the gatherings was made at a greater depth than 25 metres, so that the material collected represents the surface fauna. 30 of the tow-nettings were taken during hours of darkness and 32 during daylight. Euphausians occurred in 19 of the night hauls and in only two of the daylight hauls; moreover, those found in the day nets were larval forms only. The species, with the approximate numbers of specimens of each, are:

Euphausia americana	1,000 specimens.
„ *brevis*	200 „
„ *tenera*	47 „
„ *hemigibba*	24 „
Thysanopoda tricuspidata	4 „
„ *aequalis*	6 „
Nematoscelis microps	12 „
Stylocheiron carinatum	25 „
„ *suhmii*	15 „
„ *abbreviatum*	1 „

The striking preponderance in numbers of the genus *Euphausia* (95 per cent. of the specimens captured) in the surface waters of the Atlantic at night is well brought out by these figures.

The evidence as to the distribution and diurnal vertical oscillation of species of Euphausians provided by the "Terra Nova" collections is far from satisfactory. No gatherings were made at a greater depth than 25 metres, so that no information is forthcoming as to the Euphausian fauna of the intermediate depths of the ocean. Moreover, no comparable hauls were made at the surface and at various depths at the same time from which information as to the possible movements of Euphausians might have been gleaned. But, taken as it stands and for what it is worth, the evidence from this collection does suggest that, for some reason or other, Euphausians are much more easily caught at the surface at night than during the day. The possible explanations for this may be either (1) that Euphausians, except in the

larval and post-larval stages, are really absent from the surface waters in the daytime and descend to deeper water during that period; or (2) that Euphausians are present in the surface waters during the day but are able by some means to avoid the nets; or (3) that in the daylight gatherings made by the "Terra Nova" the tow-nets were hauled at too great a speed for successful results. The first of these possibilities, which demands a nocturnal rise and a diurnal fall of Euphausians, has a certain amount of evidence to support it. Holt and Tattersall (1905), and Fowler (1905), showed fairly conclusively that *Euphausia krohnii* exhibited such movements, and they suggested that *Nematoscelis megalops* also did, though the evidence was less clear. Esterley (1914) showed that *Euphausia pacifica* and *Nyctiphanes simplex* probably performed similar daily movements, the evidence being considerably strengthened by the fact that at the times the increase in numbers took place in the upper waters there was a corresponding decrease in the deeper waters. An examination of the records of the capture of Euphausians scattered throughout literature would certainly suggest such daily movements, and I believe that they are characteristic of the epiplanktonic species of oceanic Euphausians at least. At the same time, the second possibility mentioned above, that Euphausians are present in surface waters by daylight but by some means or other avoid the nets, must not be overlooked. Holt and Tattersall suggested this explanation of the apparent absence of *Meganyctiphanes norvegica* from the surface by daylight in the Bay of Biscay. Fowler admitted the possible truth of this explanation, but inclined to the view that there were facts which could not be accounted for on this supposition. Esterley concurred with Fowler, on the ground that certain blind Ostracods, which exhibit apparently similar diurnal movements, cannot be supposed to avoid the nets by daylight. Holt and Tattersall based their suggestion on the experience of tow-netting with a wide-mouthed net of coarse mesh towed rapidly at the surface in the coastal waters of Ireland. *Nyctiphanes couchii*, *Meganyctiphanes norvegica* and *Thysanoëssa inermis* may frequently be caught in this way at the surface during the daytime, when an ordinary tow-net worked at the surface at the same time would fail to capture any specimens. That Euphausians do sometimes occur in large numbers at the surface in the daytime in coastal waters was made clear to me by an observation which I made in the seas round Orkney and Shetland in August 1907. From the deck of the boat I could see enormous swarms of *Thysanoëssa inermis* actually at the surface; apparently they were caught in the surface film, and they were gyrating about in the manner familiar to those who have observed aquatic insects and Entomostraca in freshwater pools. The day was hot, the surface of the sea was absolutely calm, and the sun was shining brilliantly. I was able to satisfy myself as to the identity of the Euphausians, but it was not practicable to try to catch them by the ordinary methods of tow-netting. These coastal species may be subject to different factors and different conditions from oceanic ones; their reactions and their behaviour may be different; it by no means follows that oceanic species occur

at the surface in daylight in the same way. Nevertheless, these observations show that some Euphausians do occur in the surface waters by daylight, and experience in the use of wide-mouthed nets towed rapidly at the surface in daylight suggests that the avoidance theory cannot be rejected, even for oceanic species, without additional evidence. This brings me to the third possibility mentioned above, that the failure of the daylight tow-nettings to yield Euphausians may have been due to the too rapid towing of the nets. From the information contained in the list of collecting stations of the expedition, it appears that the majority of the daylight gatherings in the Atlantic were taken at "full speed." Although rapid towing is essential for a successful haul with a wide-mouthed net of coarse mesh, slow towing is necessary for ordinary tow-nets. The nets used on the "Terra Nova" were, presumably, comparatively fine-meshed, narrow-mouthed nets and, hauled at too great a speed, would catch practically nothing except the specimens contained in the net as soon as it was put into the water. When towed rapidly the mesh would be too fine to allow the net to strain the water, and the effect would be that of dragging a solid object through the water, organisms being pushed aside and not caught in the net.

The species of Euphausians caught by the "Terra Nova" in the Atlantic call for no special mention. All are widely distributed species which one would expect to find almost anywhere in tropical and subtropical seas.

NEW ZEALAND AREA.

The Euphausian fauna of New Zealand is comparatively little known. The previous records of Euphausians from these waters (including the seas round the south-east of Australia) may be summarized as follows:

Euphausia recurva, Hansen. The specimens obtained by the "Challenger" between Sydney and Wellington and recorded by Sars as *E. pellucida* have recently been re-examined by Dr. Hansen and determined as *E. recurva*.

Euphausia lucens, Hansen. Between New Zealand and Tasmania (Hansen, 1911).

Euphausia similis, var. *armata*, Hansen. Between New Zealand and Tasmania (Hansen, 1911).

Euphausia tenera, Hansen (= *E. gracilis*, G. O. Sars). Australian seas off Port Jackson, 33° 30′ S. ("Challenger").

Euphausia spinifera, G. O. Sars. 48° 18′ S., 131° 11′ E. ("Challenger").

Pseudeuphausia latifrons, G. O. Sars. Australian seas, off Port Jackson, and 36° 57′ S., 150° 34′ E. ("Challenger").

Nyctiphanes australis, G. O. Sars. Several localities in the south-eastern waters of Australia ("Challenger"). New Zealand waters (G. M. Thomson).

Thysanoëssa gregaria, G. O. Sars. Several localities off the Australian coasts ("Challenger"). Kermadec Islands (Chilton, 1911).

This gives a total of eight species known chiefly as a result of the "Challenger" Expedition. The "Terra Nova" collections were made to the north of New Zealand, almost on the fringe of the tropical zone. They comprise twelve species, of which only five had been previously recorded in this area; the remaining seven were all species known from tropical and sub-tropical seas which may here reach, or approach, the southern limit of their range.

The fifteen species now known from this area may be classified according to their distribution, as follows:

1. Coastal Species.

Pseudeuphausia latifrons. Widely distributed in coastal waters in the southern tropical and sub-tropical oceans.

Nyctiphanes australis. Confined to this area.

2. Oceanic species more or less widely distributed in the South Temperate Zone.

Euphausia recurva.

„ *lucens.* (Occasionally penetrates to the sub-Antarctic zone.)

„ *similis*, var. *armata.* (Occasionally tropical.)

„ *spinifera.*

3. Oceanic species more or less widely distributed in the North and South Temperate Zones, but rarely found in tropical waters.

Thysanoëssa gregaria. (Recorded from the Kermadec Islands.)

4. Oceanic species more or less widely distributed in tropical and sub-tropical waters.

Euphausia tenera.
Thysanopoda obtusifrons.
Nematoscelis microps.
Nematobrachion flexipes.
Stylocheiron carinatum.
„ *longicorne.*
„ *suhmii.*
„ *abbreviatum.*

The most abundant species in the "Terra Nova" collections are *Euphausia recurva*, *Nyctiphanes australis*, and *Thysanoëssa gregaria*, and they are probably the commonest species in the area. The Euphausian fauna, therefore, of New Zealand is predominantly south temperate in facies.

In attempting an analysis of the plankton gatherings made in this area, from the standpoint of the Euphausians, it is to be noted that altogether 72 tow-nettings were made by the "Terra Nova," 43 by daylight and 29 during hours of darkness. Euphausians occurred in 17 of the day hauls (40 per cent.) and in 22 of the night hauls (76 per cent.). Moreover, the actual numbers of specimens caught were much larger in the night gatherings, and the greater part of the Euphausians taken in the daytime were larval and post-larval forms.

The 39 gatherings in which Euphausians occurred were distributed as follows as to time and depth :

	Depth.	Daylight.	Darkness.
25	0	9	16
1	1 metre	1	0
3	2 metres	1	2
5	3 ,,	2	3
1	10 ,,	1	0
1	20 ,,	0	1
1	30 ,,	1	0
1	0–100 ,,	1	0
1	0–120 ,,	1	0
39		17	22

The species, with the approximate number of each, taken in this area, were :

Thysanopoda obtusifrons	1
Nyctiphanes australis	4,000
Euphausia recurva	1,000
,, *similis*, var. *armata*	4
,, *spinifera*	1
Thysanoëssa gregaria	250
Nematoscelis microps	30
Nematobrachion flexipes	6
Stylocheiron carinatum	13
,, *longicorne*	2
,, *suhmii*	3
,, *abbreviatum*	19

None of the gatherings was made at a greater depth than 120 metres = 66 fathoms. This list, therefore, gives a good idea of the epiplanktonic species of Euphausians in the waters of New Zealand during the months of July, August, and September.

An analysis of the details of each haul presents one or two points of interest concerning the more abundant species.

TABLE I. SURFACE NETS.

Time.	Month.	Station.	*Nyct. australis.*	*Euph. recurva.*	*Thys. gregaria.*
Day	July	75	1	0	0
,,	Aug.	100	2	23	0
,,	,,	101	6	1	0
,,	,,	102	0	2	0
,,	,,	108	9	0	0
,,	,,	111	1	1	0
,,	,,	126	1	0	5
,,	Sept.	138	2	0	0
,,	,,	140	0	0	2

TABLE I. SURFACE NETS (*continued*).

Time.	Month.	Station.	*Nyct. australis.*	*Euph. recurva.*	*Thys. gregaria.*
Night	July	77	0	4	0
,,	,,	89	1,000	53	1
,,	,,	92	3	20	7
,,	,,	93	21	78	2
,,	Aug.	106	2,000	20	20
,,	,,	107	61	13	0
,,	,,	118	3	0	0
,,	,,	120	1	39	1
,,	,,	122	45	61	3
,,	,,	127	40	100	30
,,	,,	128	4	2	0
,,	,,	129	350	151	0
,,	,,	130	7	9	0
,,	Sept.	136	10	72	42
,,	,,	139	300	7	0
,,	,,	143	0	0	17

TABLE II. NETS AT VARIOUS DEPTHS.

Time.	Month.	Station.	Depth.	*Nyct. australis.*	*Euph. recurva.*	*Thys. gregaria.*
Day	July	88	1 metre	0	0	0
,,	,,	83	2 metres	0	0	0
,,	Aug.	112	3 ,,	0	0	7
,,	,,	113	3 ,,	0	0	5
,,	,,	132	10 ,,	0	50	0
,,	July	87	30 ,,	1	1	0
,,	,,	80	0–100 ,,	0	3	5
,,	,,	74	0–120 ,,	0	0	0
Night	,,	84	2 ,,	0	0	0
,,	,,	85	2 ,,	0	50	6
,,	,,	86	3 ,,	160	33	2
,,	Aug.	109	3 ,,	4	16	100
,,	,,	135	3 ,,	8	50	20
,,	,,	133	20 ,,	85	103	17

In Table I the surface tow-nettings are arranged under two groups, daylight and darkness, and in Table II the remaining tow-nettings are arranged in order of depths under the same two groups. The evidence derived from these tables is far from satisfactory. The tow-nettings were made at various speeds, and possibly with different nets; they extended over a considerable period, during which the meteorological conditions may have varied considerably. Corrections for each of these factors should be made if the results are to be strictly comparable. This cannot be done, but I think it is possible to say, from the figures as they stand, that Euphausians were more abundant in the upper waters during hours of darkness than in daylight, and there is a suggestion that the three common species, *Nyctiphanes australis*, *Euphausia recurva*, and *Thysanoëssa gregaria* exhibit some kind of diurnal vertical movements, rising to the surface at night and descending to deeper waters during the day. Of

the other species which occurred in comparatively small numbers, the following notes may be given.

Thysanopoda obtusifrons.—One specimen, at the surface at night.

Euphausia similis, var. *armata.* Four specimens, two at the surface, two at 3 metres, all at night.

Euphausia spinifera.—One larva, at the surface at night.

Nematoscelis microps.—All the specimens were larval or post-larval, occurring in the daytime only in hauls at 30 metres, and from 100 metres to the surface; at night only at the surface.

Nematobrachion flexipes.—All the specimens were post-larval, occurring in the daytime in one haul from 100 metres to the surface; at night at the surface only.

Stylocheiron carinatum.—At night at the surface only, in daylight from one haul at 30 metres.

S. longicorne.—At night at the surface only.

S. suhmii.—At night from the surface, and in the daytime from one haul at 2 metres.

S. abbreviatum.—All the specimens were larval or post-larval, occurring in the daytime in one haul from 100 metres to the surface; at night at the surface only.

It will be noted that none of these species occurred at the surface during the day, and that the majority of the specimens were in the larval and post-larval stages.

ANTARCTIC AND SUB-ANTARCTIC ZONES.

Regan (1914) has defined the limits of these two zones as the mean annual surface isotherms of 6° C. and 12° C. respectively. His suggested geographical division of the waters to the south of the tropical zone is based on the study of the coastal fishes of the southern hemisphere. Dealing with the pelagic fishes he is of the opinion that our knowledge of the distribution of these fishes is not sufficiently complete to permit of co-ordination with the results of his investigation of the coastal fishes.

The Euphausians are essentially a pelagic group of animals the distribution of which is probably largely influenced by such factors as temperature and salinity. Information on these points is very deficient in the published literature dealing with the occurrences of Euphausians and is quite inadequate for the purpose of an attempt to delimit geographical zones on hydrographical lines. It may, however, not be without interest to consider the facts already published, with a view to discovering whether they lend any support to the conclusions arrived at by Regan from the study of coastal fishes.

Taking the limits of these zones as defined by Regan, the following species of Euphausians have been recorded from localities to the south of the mean annual isotherm of 12° C.

Euphausia similis
„ *lucens*
„ *spinifera*
„ *frigida*
„ *vallentini*
„ *longirostris*
Euphausia triacantha
„ *superba*
„ *crystallorophias*
Thysanoëssa macrura
„ *vicina*
Stylocheiron maximum

This list of species is the result of the extensive exploration of the Antarctic Ocean and the surrounding seas which has taken place during the last twenty-five years: it is unlikely that it will be materially increased by future work and it may be regarded as fairly representative of the Euphausian fauna of this area.

One of the most striking features of this list of species is the complete absence of representatives of the genera *Bentheuphausia*, *Thysanopoda*, *Pseudeuphausia*, *Nyctiphanes*, *Meganyctiphanes*, *Tessarobrachion*, *Nematoscelis*, and *Nematobrachion* and the presence of only one species of the large and widely distributed genus *Stylocheiron*. Species of these genera occur abundantly in the waters immediately to the north of the isotherm of 12° C., as may be seen from the "Challenger" report and the work of Hansen and Zimmer. This isotherm, if not an absolutely accurate œcological boundary, certainly marks off an area characterized by the poverty of genera of Euphausians. Further, it is to be noticed that none of the genera is peculiar to these regions, but all have a world-wide geographical range. On the other hand, a consideration of the geographical distribution of the species in the above list reveals the fact that certain species, so far as is known at present, appear to be confined to the area now under notice.

The species may be divided into the following groups according to their geographical distribution:

1. Deep-water species with a wide geographical range.

Euphausia similis
Stylocheiron maximum

2. Species the centre of whose distribution lies in the South Temperate Zone but which occasionally penetrate to the sub-Antarctic region.

Euphausia lucens
„ *spinifera*

3. Species the centre of whose distribution lies in the area to the south of the mean isotherm of 12° C. but which occasionally penetrate to south temperate waters.

Euphausia vallentini
„ *longirostris*

4. Species whose known distribution is entirely within the limits of the isotherm of 12° C.

Euphausia frigida
„ *triacantha*
„ *superba*
Euphausia crystallorophias
Thysanoëssa macrura
„ *vicina*

It will be seen, therefore, that half of the species found in this area are peculiar, and have not been found anywhere outside it.

The overlapping of the species on the borders of the south temperate and the sub-Antarctic zones as evidenced by groups 2 and 3 may possibly be explained by the variation of the isotherm of 12° C. in individual years and by its movement during the year. In other words, a knowledge of the temperature of the water at the time of capture would probably determine absolutely into which of the two groups, south temperate or sub-Antarctic, the doubtful species should go. I should be inclined to regard group 2 as south temperate forms, and group 3 as sub-Antarctic. The species in group 1 are in a different category; they are deep-water species whose isothermal range is probably a vertical instead of a horizontal one and whose distribution is therefore correspondingly wide. The remaining species are all, so far as can be seen, surface and upper-water forms whose distribution, if influenced by temperature or hydrographical factors, can most usefully furnish data for the delimitation of geographical zones. It is, perhaps, worth noting here, that, of the species of the genus *Euphausia*, only groups *b* and *d* (of Hansen) are represented in the Antarctic and sub-Antarctic fauna. Groups *a* and *c* are entirely absent, and this peculiarity may be added to those characterizing this fauna.

It will be seen, therefore, that the distribution of the Euphausiacea lends some support to Regan's suggested geographical division of the southern waters of the world. The isotherm of 12° C., or thereabouts, marks off a southern area characterized, so far as Euphausians are concerned, by a poverty of genera and a large percentage of peculiar species.

On the other hand, the division between the Antarctic and sub-Antarctic zones as defined by Regan is much less marked in the Euphausians. Only two species, *Euphausia superba* and *Euphausia crystallorophias*, appear to be confined to the Antarctic zone. *E. vallentini* and *E. frigida*, though mainly sub-Antarctic, occasionally penetrate to the Antarctic zone, and *E. triacantha* is entirely sub-Antarctic. The two species of *Thysanoëssa* range over the whole area. In the following pages I use the terms Antarctic and sub-Antarctic in the sense defined by Regan, to give more precision to the geographical range of species.

II.—LIST OF SPECIES.

The classification and arrangement of species followed in this report are those of Hansen, suggested in his paper "The genera and species of the order Euphausiacea, with account of remarkable variation." (*Bull. Instit. Ocean. Monaco*, No. 210, 1911.)

Order EUPHAUSIACEA.

Family EUPHAUSIIDAE.

Genus THYSANOPODA, H.M.-Edw.

1. *Thysanopoda tricuspidata*, H. M.-Edw.
2. *Thysanopoda aequalis*, Hansen.
3. „ *obtusifrons*, G. O. Sars.

Genus NYCTIPHANES, G. O. Sars.

4. *Nyctiphanes australis*, G. O. Sars.

Genus EUPHAUSIA, Dana.

5. *Euphausia americana*, Hansen.
6. „ *recurva*, Hansen.
7. „ *brevis*, Hansen.
8. „ *superba*, Dana.
9. „ *tenera*, Hansen.
10. „ *similis*, G. O. Sars.
11. „ „ G. O. Sars, var. *armata*, Hansen.
12. *Euphausia crystallorophias*, Holt and Tattersall.
13. *Euphausia lucens*, Hansen.
14. *Euphausia frigida*, Hansen.
15. „ *vallentini*, Stebbing.
16. „ *hemigibba*, Hansen.
17. „ *longirostris*, Hansen.
18. „ *spinifera*, G. O. Sars.

Genus THYSANOËSSA, Brandt.

19. *Thysanoëssa gregaria*, G. O. Sars.
20. „ *vicina*, Hansen.
21. „ *macrura*, G. O. Sars.

Genus NEMATOSCELIS, G. O. Sars.

22. *Nematoscelis microps*, G. O. Sars.

Genus NEMATOBRACHION, Calman.

23. *Nematobrachion flexipes*, Ortmann.

Genus STYLOCHEIRON, G. O. Sars.

24. *Stylocheiron carinatum*, G. O. Sars.
25. *Stylocheiron suhmii*, G. O. Sars.
26. „ *longicorne*, G. O. Sars.
27. *Stylocheiron abbreviatum*, G. O. Sars.

III.—LIST OF STATIONS AT WHICH SPECIMENS WERE OBTAINED.

Tropical and sub-Tropical Atlantic.

Station	43.	May	3,	1913,	22° 6′ S., 39° 40′ W., surface, 12.30–1 a.m.	Plankton.
„	45.	„	4,	„	21° S., 37° 50′ W., surface, 12.50–1.30 a.m.	Plankton.
„	46.	„	4,	„	20° 30′ S., 36° 30′ W., surface, 10.30–11 p.m.	Plankton.
„	47.	„	4,	„	20° 30′ S., 36° 30′ W., surface, 10.30–11 p.m.	Plankton.
„	49.	„	6,	„	18° 51′ S., 33° 40′ W., surface, 4.30–5 a.m.	Plankton.

TROPICAL AND SUB-TROPICAL ATLANTIC—*continued.*

Station	50.	May	7,	1913,	18° S., 31° 45′ W., surface, 12.35–1.15 a.m. Plankton.
,,	52.	,,	12,	,,	5° S., 27° 15′ W., 2 metres, 4–6 p.m. Plankton.
,,	53.	,,	12,	,,	5° S., 27° 15′ W., 2 metres, 6–7 p.m. Plankton.
,,	58.	,,	16,	,,	0°, 25° 15′ W., surface, 1–1.30 a.m. Plankton.
,,	59.	,,	16,	,,	0°, 25° 15′ W., surface, 1–1.30 a.m. Plankton.
,,	61.	,,	17,	,,	2° N., 24° 45′ W., surface, 1–1.30 a.m. Plankton.
,,	62.	,,	18,	,,	4° 50′ N., 24° W., surface, 1–1.30 a.m. Plankton.
,,	63.	,,	19,	,,	6° 10′ N., 24° 5′ W., surface, 2–2.30 a.m. Plankton.
,,	64.	,,	26,	,,	23° 28′ N., 34° 45′ W., surface, 1.30–2 a.m. Plankton.
,,	65.	,,	26,	,,	23° 28′ N., 34° 45′ W., surface, 1.30–2 a.m. Plankton.
,,	66.	,,	27,	,,	25° 35′ N., 34° 10′ W., surface, 1.30–2 a.m. Plankton.
,,	67.	,,	27,	,,	25° 35′ N., 34° 10′ W., surface, 1.30–2 a.m. Plankton.
,,	68.	,,	28,	,,	27° 22′ N., 33° 40′ W., surface, 1.30–2 a.m. Plankton.
,,	69.	,,	29,	,,	29° 10′ N., 33° 36′ W., surface, 1.30–2 a.m. Plankton.
,,	70.	June	2, 3,	,,	Off Horta Harbour, Fayal, Azores, 12 metres, 6 p.m.–8 a.m. Plankton.
,,	311.	April	22,	,,	35° 29′ S., 50° 26′ W., 2 metres, 8–10 a.m. Plankton.

NORTH OF NEW ZEALAND AND NEIGHBOURING WATERS.

Station	74.	July	17,	1911,	From summit Gt. King, W., 5½ miles, 0–120 metres, noon. Plankton.
,,	75.	,,	17,	,,	From summit Gt. King, W., 8 miles, surface, 3–3.30 p.m. Plankton.
,,	77.	,,	18,	,,	34° 5′ S., 171° 48′ E., surface, 5–7 p.m. Plankton.
,,	80.	,,	22,	,,	From summit Gt. King, N. 87° W., 11 miles, 0–100 metres, 5 p.m. Plankton.
,,	83.	,,	23,	,,	From summit Gt. King, S. 40° E., 29 miles, 2 metres, 1–4 p.m. Plankton.
,,	84.	,,	23,	,,	From Cape Maria van Diemen Light, S.W. by W., 15 miles, 8–9 p.m. Plankton.
,,	85.	,,	24,	,,	From Cape Maria van Diemen Light, W.N.W., 24 miles, 2 metres, 1–5 a.m. Plankton.
,,	86.	,,	24, 25,	,,	Off Three Kings Islands, 3 metres, 8 p.m.–5 a.m. Plankton.
,,	87.	,,	25,	,,	From summit Gt. King, S. ½° W., 10 miles, 30 metres, noon. Plankton.
,,	88.	,,	25,	,,	From summit Gt. King, S. ½° W., 10 miles, 1 metre, noon. Plankton.
,,	89.	,,	25,	,,	Off Three Kings Islands, surface, 8–10 p.m. Plankton.
,,	92.	,,	26, 27,	,,	From summit Gt. King, S. by W., 24 miles, surface, 9 p.m.–4 a.m. Plankton.
,,	93.	,,	27, 28,	,,	From summit Gt. King, S.E. by S., 13 miles, surface, 9 p.m.–4 a.m. Plankton.
,,	100.	Aug.	4,	,,	From West I., Three Kings Islands, S.W., 5 miles, surface, 1–2 p.m. Plankton.
,,	101.	,,	4,	,,	From West I., Three Kings Islands, S.W., 5 miles, ,, 4–5 p.m. Plankton.
,,	102.	,,	4,	,,	From West I., Three Kings Islands, S.W., 5 miles, ,, 3–4 p.m. Plankton.
,,	106.	,,	4,	,,	From West I., Three Kings Islands, S.W., 5 miles, ,, 7–8 p.m. Plankton.
,,	107.	,,	4, 5,	,,	From West I., Three Kings Islands, S.W., 5 miles, ,, 8 p.m.–5.30 a.m. Plankton.
,,	108.	,,	5,	,,	34° 15′ S., 172° E., surface, noon–4 p.m. Plankton.
,,	109.	,,	5, 6,	,,	34° 15′ S., 172° E., 3 metres, 8 p.m.–8 a.m. Plankton.
,,	110.	,,	6, 7,	,,	34° 4′ S., 171° 55′ E., surface, 9 p.m.–4 a.m. Plankton.
,,	111.	,,	7,	,,	Off Three Kings Islands, surface, 10 a.m.–1 p.m. Plankton.
,,	112.	,,	8,	,,	33° 37′ S., 171° 30′ E., 3 metres, noon–4 p.m. Plankton.

North of New Zealand and Neighbouring Waters—*continued.*

Station 113. August 9, 1911, 33° 12′ S., 171° 5′ E., 3 metres, 9 a.m.–noon. Plankton.
,, 118. ,, 16, 17, ,, 34° 32′ S., 172° 20′ E., surface, 9 p.m.–5 a.m. Plankton.
,, 120. ,, 17, 18, ,, 34° 26′ S., 172° 14′ E., surface, 9 p.m.–5 a.m. Plankton.
,, 122. ,, 18, 19, ,, From Cape Maria van Diemen, S. 80° W., 21 miles, surface, 9 p.m.–5 a.m. Plankton.
,, 126. ,, 24, ,, 34° 13′ S., 172° 15′ E., surface, 9 a.m.–12 noon. Plankton.
,, 127. ,, 25, ,, Off Three Kings Islands. surface, 9 p.m.–5 a.m. Plankton.
,, 128. ,, 25, 26, ,, Off Three Kings Islands. ,, 9 p.m.–6 a.m. Plankton.
,, 129. ,, 25, 26, ,, Off Three Kings Islands. ,, 6 p.m.–6 a.m. Plankton.
,, 130. ,, 26, 27, ,, Off Three Kings Islands. ,, 8 p.m.–6.30 a.m. Plankton.
,, 132. ,, 29, ,, Spirits Bay, near North Cape, 10 metres, 9 a.m.–noon. Plankton.
,, 133. ,, 30, 31, ,, Spirits Bay, near North Cape, 20 metres, 8 p.m.–6 a.m. Plankton.
,, 135. ,, 31, 1, ,, Spirits Bay, near North Cape, 3 metres, 9 p.m.–6.30 a.m. Plankton.
,, 136. Sept. 1, 2, ,, Spirits Bay, near North Cape, surface, 9 p.m.–6.30 a.m. Plankton.
,, 138. ,, 5, ,, Off Three Kings Islands, surface, 2–3.30 p.m. Plankton.
,, 139. ,, 5, 6, ,, 34° 30′ S., 171° 53′ E., surface, 9 p.m.–6.30 a.m. Plankton.
,, 140. ,, 6, ,, 34° 30′ S., 171° 53′ E., surface, 10 a.m.–4 p.m. Plankton.
,, 143. ,, 8, 9, ,, 34° 58′ S., 170° 12′ E., surface, 4 p.m.–9 a.m.

Sub-Antarctic Zone.

Station 232, Mar. 24, 1912, 55° 51′ S., 165° 49′ E., surface, 10–11 a.m. Plankton.
,, 235. ,, 26, ,, 52° 41′ S., 168° 15′ E., 10 metres, 7–10 p.m. Plankton.
,, 236. ,, 27, ,, 52° 11′ S., 167° 25′ E., 80 metres, 6–8 p.m. Plankton.
,, 237. ,, 27, ,, 52° 11′ S., 167° 25′ E., 10 metres, midnight–8 a.m. (27–28). Plankton.
,, 238. ,, 27, ,, 52° 11′ S., 167° 25′ E., 30 metres, 10–10.30 a.m. Plankton.
,, 239. ,, 27, ,, 52° 11′ S., 167° 25′ E., birds' stomachs.
,, 240. ,, 28, ,, 51° 57′ S., 167° 38′ E., 4 metres, 8.30–9 a.m. Plankton.
,, 241. ,, 28, ,, 51° 57′ S., 167° 38′ E., surface, 9 p.m. (27)–4 a.m. (28). Plankton.
,, 248. Dec. 18, ,, 51° 22′ S., 179° 18′ W., surface, 7 p.m. Plankton.
,, 251. ,, 20, ,, 54° 2′ S., 177° 0′ W., surface, 8–8.30 p.m. Plankton.
,, 256. ,, 21, ,, 54° 38′ S., 176° 24′ W., 20 metres, 10 p.m. Plankton.
,, 259. ,, 22, ,, 55° 34′ S., 174° 35′ W., 20 metres, 9 p.m. Plankton.
,, 302. Feb. 3, 1913 58° 21′ S., 158° 5′ E., 20 metres, 8.30 p.m. Plankton.
,, 305. Mar. 21, ,, 56° 41′ S., 162° 5′ W., surface, 9–9.30 p.m. Plankton.

Antarctic Ocean (Ross Sea Area).

Station 167. Dec. 7, 1910, 61° 22′ S., 179° 56′ W., surface, 4 p.m. Plankton.
,, 181. ,, 22, ,, 68° 41′ S., 179° 28′ W., birds' stomachs.
,, 185. ,, 30, ,, 72° 17′ S., 177° 9′ E., 1 metre, noon. Plankton.
,, 186. ,, 31, ,, 72° 51′ S., 174° 55′ E., surface, midnight. Plankton.
,, 188. Jan. 1, 1911, 73° 5′ S., 174° 11′ E., surface, 11 a.m. Plankton.
,, 213. Dec. 24, ,, 60° 39′ S., 178° 40′ W., surface, 9 a.m.–12 noon. Plankton.
,, 221. Jan. 9, 1912, North, true, of Drygalski Glacier Tongue, Terra Nova Bay, 10 metres, 1–2 p.m. Plankton.
,, 222. ,, 10, ,, 76° 3′ S., 165° 55′ E., 10 metres, 1–2 p.m. Plankton.
,, 224. Mar. 9, ,, 60 miles east of Cape Adare, 1 metre, 7–9 p.m. Plankton.
,, 225. ,, 11, ,, 69° 45′ S., 177° 19′ E., 20 metres, 2–4 p.m. Plankton.
,, 228. ,, 17, 18, ,, 64° 3′ S., 160° 12′ E., surface, 9 p.m.–4 a.m. Plankton.
,, 229. ,, 18, ,, 64° 3′ S., 160° 12′ E., 80 metres, 8.30–9 a.m. Plankton.
,, 264. Dec. 26, ,, 64° 33′ S., 166° 30′ W., 20 metres, 9 p.m. Plankton.

ANTARCTIC OCEAN (ROSS SEA AREA)—*continued.*

Station 267. Dec. 27, 1912, 66° 30′ S., 166° 8′ W., surface, 8–8.30 p.m. Plankton.
,, 269. ,, 28, ,, 68° 37′ S., 166° 14′ W., surface, 6–8 p.m. Plankton.
,, 270. ,, 29, ,, 69° 51′ S., 166° 17′ W., 0-600 metres, 8 p.m. Plankton.
,, 272. Jan. 1, 1913, 71° 35′ S., 166° 1′ W., 80 metres, 4 p.m. Plankton.
,, 274. ,, 3, ,, 71° 29′ S., 166° W., 80 metres, 9 a.m.–12 noon. Plankton.
,, 275. ,, 3, ,, 71° 29′ S., 166° W., 160 metres, 1–5 p.m. Plankton.
,, 282. ,, 6, 7, ,, 71° 41′ S., 166° 47′ W., 0–1,000 metres, 8 p.m.–8 a.m. Plankton.
,, 285. ,, 8, ,, 71° 49′ S., 167° 32′ W., 0–600 metres, 8–10 p.m. Plankton.
,, 289. ,, 11, 12, ,, 72° S., 168° 17′ W., 24 metres, 8 p.m.–9 a.m. Plankton.
,, 290. ,, 12, ,, 72° S., 168° 17′ W., 60 metres, 9 a.m.–3 p.m. Plankton.
,, 298. Feb. 1, ,, 63° 11′ S., 158° 52′ E., 12 metres, 8.30 p.m. Plankton.
,, 300. ,, 2, ,, 61° 18′ S., 157° 33′ E., 0–140 metres, 10 p.m. Plankton.
,, 317. June 7–Oct. 14, 1911, Hole in the ice between Cape Evans and Inaccessible Island, 175 metres. Plankton.
,, 332. Jan. 16, 1912, 77° 15′ S., 166° E., 0–550 metres, 2 a.m. Plankton.
,, 337. ,, 22, ,, Off Cape Bird Peninsula, 80 metres, 10.30 a.m.–noon. Plankton.
,, 342. ,, 31, ,, } Off Cape Royds, { 0–350 metres, 4 p.m. Plankton.
,, 343. Feb. 1, ,, } { 0–600 metres, noon. Plankton.
,, 344. ,, 1, ,, } { 0–400 metres, 3 p.m. Plankton.
,, 345. ,, 2, ,, McMurdo Sound, 0–500 metres, 8.30–9.30 a.m. Plankton.
,, 346. ,, 3, ,, McMurdo Sound, 0–450 metres, 9 a.m.–5 p.m. Plankton.
,, 350. Mar. 4, ,, Off Glacier Tongue, McMurdo Sound, 250 metres, 2–4 p.m. Plankton.
,, 351. April 26–June 7, 1912, Hole in ice between Cape Evans and Inaccessible Island, 205 metres. Plankton.
,, 357. Jan. 22, 1913, 77° 1′ S., 163° 22′ E., 12 metres, 2–6 p.m. Plankton.

IV.—DESCRIPTIONS OF SPECIES.

ORDER EUPHAUSIACEA.

FAMILY EUPHAUSIIDAE.

GENUS THYSANOPODA, H. Milne-Edw.

1. *Thysanopoda tricuspidata*, H. M.-Edw.

T. tricuspidata, H.M.-Edw., 1830, p. 451, pl. XIX; G. O. Sars, 1885, p. 98, pl. XVII; Hansen, 1910, p. 82, pl. XII, figs. 3*a*–3*b*; Hansen, 1912, p. 208, pl. IV, fig. 2*a*.

Occurrence.—Atlantic Ocean. Station 45, two females, 10–11 mm. Station 53, two females, 7–17 mm.

Remarks.—All the specimens were taken at the surface at night. A general survey of the records of the capture of this species shows that during the hours of darkness it is taken in the surface waters frequently in the larval and post-larval stages, more rarely when adult. Hansen (1910) records it from thirty-seven hauls, thirteen of which were at the surface and the majority at quite shallow depths; no times are given at which the hauls were made. Of Hansen's specimens, only

two out of 193 were adult (and these were captured in vertical nets from 1,000 m. and 1,500 m. to surface), and as the series of hauls extended over a complete year Hansen concludes that this species breeds all the year round. I myself have recorded it from the surface in the Indian Ocean (1911), but have no notes as to the time of capture or the state of maturity of the specimens. Hansen (1912) gives several records of this species from the Atlantic Ocean and the China Sea, all from surface hauls at night and, in 1913, notes its occurrence in the tropical Atlantic, all the specimens being larvæ taken at the surface; when the times of the hauls are given, they are during hours of darkness. All the records given by me in 1913 were of larvæ taken at the surface (with the exception of one adult), but no times are available. Zimmer (1914) records this species in twelve gatherings made in the tropical Atlantic; in three made at the surface all the specimens were in the larval state; no times are given. The most conclusive evidence is provided by Hansen's records in 1916; the species is there recorded from nineteen stations in the tropical Pacific. Of fourteen night hauls ten were made at the surface, one at 5 fathoms, one at 20 fathoms, one at 20–30 fathoms, and one at 200 fathoms; in three of the surface nets and in the one at 20–30 fathoms, the number of specimens is given as "very many." On the other hand, no records from the surface during daylight are given. The day tow-nettings were made at depths of 800, 310, 115, 146, and 600 fathoms, and the number of specimens in each was 1, 2, 1, 3, and 1 respectively. Evidence of this nature is, of course, far from satisfactory; the tow-nettings do not extend over a long enough period, nor is there material for a direct comparison between surface and deep-water hauls made at the same time. But taking the available information as a whole it suggests that *T. tricuspidata* is more frequently taken at the surface during the hours of darkness than in daylight and that in the upper waters the larval stages are found more frequently than the adults.

Distribution.—This species is found in the tropical waters of the globe only, but within that belt has a wide distribution in the Atlantic, Pacific, and Indian Oceans.

2. *Thysanopoda aequalis*, Hansen. (Pl. II, figs. 5, 6.)

T. aequalis, Hansen, 1905 (2), p. 18; Hansen, 1910, p. 84, pl. XII, figs. 4*a*–4*c*, pl. XIII, fig. 1*a*; Hansen, 1912, p. 214, pl. 4, fig. 4*a*; Zimmer, 1914, p. 417, pl. XXVI, figs. 53, 54; *T. obtusifrons*, Lo Bianco, 1901, 1903, and 1904; Thiele, 1905; Ortmann, 1905, p. 964 (pars); *T. microphthalma*, Lo Bianco, 1903.

Occurrence.—Atlantic Ocean. Station 46, one female, 12 mm.; Station 68, five females, 9–13 mm.

Remarks.—Zimmer (1914) has already called attention to the curious and interesting sexual difference in the third thoracic limbs of this species. Such a sexual difference is unique among the Euphausians, and it may be useful to reproduce here two figures to illustrate it which I had made before Zimmer's paper

was published. All the specimens in the "Terra Nova" collection were caught in surface gatherings at night. I have previously recorded this species (1911) from the surface in the Indian Ocean (no time given), and Hansen (1912 and 1913) notes its occurrence from five hauls in the tropical Atlantic at the surface, four of which were made at night. There is, therefore, a certain amount of evidence to suggest that this species, like the last, is more abundant in the upper waters at night than during the day.

Distribution.—Widely distributed in the tropical and sub-tropical waters of the Atlantic, Indian, and Pacific Oceans, and in the Mediterranean.

3. *Thysanopoda obtusifrons*, G. O. Sars.

T. obtusifrons, G. O. Sars, 1885, p. 102, pl. XVIII, figs. 1–14 ; Hansen, 1912, p. 215, pl. 4, figs. 5*a*–5*f*; *T. vulgaris*, Hansen, 1905 (1), p. 15 ; 1905 (2), p. 20 ; nec. *T. obtusifrons*, Lo Bianco, 1901, 1903, and 1904 ; Ortmann, 1905, p. 964 (= *T. aequalis*).

Occurrence.—North of New Zealand. Station 139, one female, 16 mm.

Remarks.—This record is doubly interesting ; the locality is nearer to that of the type, 32° 36′ S., 137° 43′ W., than any subsequent record, and it is the first undoubted note of the occurrence of the species at the surface of the sea. It should be noted that the specimen was caught at night. In the list of records given by Hansen (1912) and Zimmer (1914) no times are given at which the specimens were captured ; none is recorded from the surface by these authors.

Distribution.—North Atlantic, near the Azores (Hansen, 1905 (1) and (2)) ; Sargasso Sea, north and south Equatorial Current, Atlantic Ocean (Ortmann, 1893) ; south Atlantic, tropical and sub-tropical (Zimmer, 1914) ; Indian Ocean, off Western Australia, south Pacific (G. O. Sars, 1885). Alcock and Anderson's record (1894) from near the Laccadives may refer to *T. aequalis*, but the specimens require re-examination in the light of recent work. The species appears to be, therefore, a tropical and sub-tropical form of wide distribution in the Atlantic, Indian, and south Pacific Oceans, but absent from the north Pacific.

Genus NYCTIPHANES, G. O. Sars.

4. *Nyctiphanes australis*, G. O. Sars.

N. australis, G. O. Sars, 1885, p. 115, pls. XX, XXI, figs. 1–7, p. 150, pl. XXVIII ; G. M. Thomson, 1900, p. 485 ; Hutton, 1904, p. 255 ; Hansen, 1911, p. 20 ; Hansen, 1912, pp. 226–9, pl. 6, figs. 3*a*–3*e* ; G. M. Thomson, 1913 ; Thomson & Anderton, 1921, p. 108 ; nec. *N. australis*, Stebbing, 1905 and 1910 (= *N. capensis*) ; nec. *N. australis*, Ortmann, 1894 (= *N. simplex* and *Euphausia recurva*).

Occurrence.—North of New Zealand. Taken at twenty-seven stations, often in very large numbers.

Remarks.—An analysis of the various gatherings in which this species was found is given on pp. 6, 7. From this it will be seen that it was much more abundant in the upper waters during the night time than in daylight. None of the plankton

gatherings in this area were made at depths greater than 150 metres, so there is no evidence as to what becomes of this species during the daytime.

Distribution.—So far as is known at present, this species is confined to the temperate seas of southern Australia and New Zealand. All records from places outside this area have been proved to refer to other species.

Genus EUPHAUSIA, Dana.

5. *Euphausia americana*, Hansen.

E. americana, Hansen, 1911, p. 23, fig. 6; Hansen, 1913, p. 25; Tattersall, 1913, p. 873; Zimmer, 1914, p. 424; Hansen, 1915, p. 74; Zimmer, 1915, p. 178; Zimmer, 1916, p. 61; Hansen, 1921, p. 6.

Occurrence.—Atlantic Ocean. Stations 43, 45, 46, 47, 49, 52, 53, 58, 59, 61, 62, 63. A very large number of specimens of both sexes, up to 12 mm. in length.

Remarks.—All the specimens were taken in the surface waters at night. The species seems to be a purely surface and upper-water form.

Distribution.—As far as at present known this species is confined to the Atlantic Ocean from about 40° N. to 40° S., being thus a tropical and sub-tropical form.

6. *Euphausia recurva*, Hansen.

E. recurva, Hansen, 1905 (2), p. 13; Hansen, 1912, p. 234, pl. VII, figs. 3*a*–3*n*; Esterley, 1914, p. 6, pl. II, fig. 30; *N. australis* (pars), Ortmann, 1894, p. 100; *E. pellucida* (pars), Ortmann, 1894, p. 101; *E. bidentata* (pars), Ortmann, 1905, p. 964.

Occurrence.—"Terra Nova." North of New Zealand. Occurred in twenty-six gatherings made in this area (Stations 71–143), about 1,000 specimens altogether, up to 12 mm. in length.

"Discovery." 37° 16′ S., 22° 28′ 30″ E., three specimens. 40° 12′ 30″ S., 32° 27′ 30″ E., twenty specimens.

Remarks.—The analysis of the hauls in which this species occurred shows that, like *N. australis*, it is more abundant at the surface at night than in daylight.

Distribution.—Atlantic, between 18° S. and 40° S., a similar belt across the southern part of the Indian Ocean, and a wide distribution in the Pacific from 35° N. to 35° S. and from New Zealand and Japan to Chile; it is thus a southern sub-tropical and temperate species in the Atlantic and Indian Oceans, and is widespread over the Pacific. It is confined to the upper waters of the ocean.

7. *Euphausia brevis*, Hansen.

E. brevis, Hansen, 1905 (2), p. 15; Hansen, 1912, p. 239, pl. VIII, figs. 1*a*–1*g*; Colosi, 1916, p. 64, fig. 3; 1917, p. 123, fig. 1; 1917, p. 181, pl. XIV, figs. 4–5; 1922, p. 5; *E. pellucida* (pars), Ortmann, 1894, p. 101; *E. bidentata* (pars), Ortmann, 1905, p. 964; *E. pellucida*, Lo Bianco, 1901, 1903, 1904.

Occurrence.—Atlantic Ocean. Stations 46, 47, 65, 66, 67, 68, 69, about two hundred specimens, up to 10 mm. in length.

Remarks.—All the specimens were taken in surface hauls at night. Most of the recorded occurrences are at the surface or in the upper waters of the sea.

Distribution.— Very widespread in the sub-tropical and tropical waters of the Atlantic and Pacific Oceans and in the southern belt of the Indian Ocean.

8. *Euphausia superba*, Dana.

E. superba, Dana, 1850; Dana, 1852, p. 654, pl. LXIII, figs. 1*a*–1*o*; Tattersall, 1908, p. 4, pl. 1. figs. 1–12; Zimmer, 1912, p. 65, pls. VIII–XIV, text-figs. 1–5; Hansen, 1913, p. 27, pl. IV, figs. 2*a*–2*g*; *E. murrayi* and *E. antarctica*, G. O. Sars, 1885; *E. australis* and *E. glacialis*, Hodgson, 1902.

Occurrence.—Antarctic zone. Station 181, from the stomachs of penguins; Station 185, two females, 38–45 mm.; Station 186, seven females, 38–42 mm.; Station 188, one female, 42 mm.; Station 224, five, 22–26 mm.; Station 225, one female, 30 mm.; Station 269, thirty-six, 17–37 mm.; Station 345, one, 27 mm.; from the stomach of a Snowy Petrel, nine.

Remarks.—All the above specimens were taken within the Antarctic Circle.

Distribution.—A purely Antarctic species, circumpolar in distribution, not yet recorded north of the mean isotherm of 6° C.

9. *Euphausia tenera*, Hansen.

E. tenera, Hansen, 1905 (2), p. 9; Hansen, 1910, p. 95, pl. XIV, figs. 3*a*–3*e*; *E. gracilis*, G. O. Sars, 1885, p. 89, pl. XV, figs. 12–23.

Occurrence.—Atlantic Ocean. Stations 47, 53, 58, 59, 61, 62, 63, forty-seven specimens, up to 9 mm. in length.

Remarks.—All the specimens were taken at the surface at night.

Distribution.—Tropical and sub-tropical belts of the Atlantic, Indian, and Pacific Oceans, generally at the surface or in the upper waters.

10. *Euphausia similis*, G. O. Sars.

E. similis, Sars, 1885, p. 79, pl. XIII, figs. 1–6; Hansen, 1911, p. 24; Hansen, 1913, p. 29, pl. IV, figs. 3*a*–3*e*.

Occurrence.—Sub-Antarctic zone. Stations 235, 241, two specimens, 10–13 mm.

Distribution.—37° 17′ S., 53° 52′ W., South Atlantic, off Buenos Ayres ("Challenger"); south Equatorial Current and 40° 20′ S., 7° 10′ E. (Ortmann, 1893); sub-Antarctic (Coutière, 1906); south Atlantic, 48° 27′–53° 10′ S., 36° 21′–55° 30′ W. (Hansen, 1913); off Japan (Hansen, 1915); 13° 38′ N., 120° 39′ E. (Hansen, 1916). These records refer to the normal form, without a spine on the third abdominal somite and with the rostral plate long and unexpanded. All the records refer to specimens captured in nets or trawls lowered to greater or lesser depths. It has not been captured at the surface and is apparently a deep-water form with a correspondingly wide distribution. Gough's record from the English Channel must be regarded as doubtful, and has indeed been deleted by the author (*Publications de Circonstance*, No. 33, 1906, p. 105).

11. *Euphausia similis*, Sars, var. *armata*, Hansen.

E. similis, var. *armata*, Hansen, 1911, p. 24, text-fig. 7 ; *E. similis*, var. *lobata*, Zimmer, 1914, p. 425, pl. XXVI, fig. 59.

Occurrence.—North of New Zealand. Stations 106, 107, and 109, four females, 18–22 mm.

Remarks.—I think that the varieties of this species, named *armata* and *lobata* by Hansen and Zimmer respectively, are really the same. Hansen's description "third abdominal segment is carinated posteriorly in the median line and produced into a compressed, somewhat short, but very conspicuous, acute process" is not fundamentally different from Zimmer's "dritte Abdominalsegment hinten oben in der Mitte ausgezogen . . . zipfelförmigen Lappen, der in seinem distalen Teile kammartig komprimiert ist". The supposed difference between them lies in the interpretation of the word "acute" in Hansen's description. The specimens in this collection agree with Zimmer's account and figure rather than with Hansen's definition.

Distribution.—South Atlantic, 40° 9′ S., and 37° 30′ S. ; Indian Ocean, 13° S., 103° 20′ E. ; between New Zealand and Tasmania (Hansen, 1911) ; South Atlantic, 26° 59′–43° 4′ S., 17° 6′–36° 22′ W. (Zimmer, 1914).

12. *Euphausia crystallorophias*, Holt and Tattersall.

E. crystallorophias, H. & T., 1906, p. 3 ; Tattersall, 1908, p. 9, pl. II, figs. 1–10, pl. IV, fig. 10 ; Hansen, 1908, p. 6, pl. I, figs. 3*a*-3*c* ; Zimmer, 1914, p. 426, pl. XXVI, figs. 60–64.

Occurrence.—Antarctic Ocean (Ross Sea Area). Station 188, one male and one female, 17 mm., one immature ; Station 221, one female, 15 mm. ; Station 317, about four hundred specimens up to 25 mm. in length ; Station 332, eight specimens, 25–32 mm. ; Station 342, three specimens, 11–27 mm. ; Station 343, one male 26 mm., and one female 22 mm. ; Station 344, two specimens, 11–17 mm. ; Station 345, three specimens, 12–15 mm. ; Station 346, three females, 20–23 mm. ; Station 350, five specimens, 12–25 mm. ; Station 351, about five hundred specimens up to 33 mm. in length.

Distribution.—All the records of this species so far published are from within the limits of pack-ice. It may, therefore, be regarded as a purely Antarctic species which has a circumpolar distribution.

13. *Euphausia lucens*, Hansen.

E. lucens, Hansen, 1905 (2), p. 9 ; Hansen, 1911, p. 26, text-fig. 8 ; Colosi, 1917, p. 183, pl. XIV, figs. 6–8 ; *E. splendens* (pars), G. O. Sars, 1885, p. 80, pl. XIII, figs. 7–17 ; ? *E. uncinata*, Colosi, 1917, p. 186, pl. XIV, figs. 9–10 ; *T. megalops*, Illig, 1908, p. 54, figs. 1–2.

Occurrence.—"Terra Nova." Sub-Antarctic zone. Stations 235–241, about fifty specimens.

"Discovery." 40° 12′ 30″ S., 32° 27′ 30″ E., two males.

Remarks.—I am doubtful of the validity of *Euphausia uncinata*, Colosi. The species is founded solely upon the form of the copulatory organs of the male, which differ from those of *E. lucens* only in having, at the base of the lateral process on the median lobe, an additional process, uncinate in shape, with a secondary tooth near the apex. In every other character *E. uncinata* agrees with *E. lucens*. If Colosi's figure of the male copulatory organ (Colosi, 1917, pl. XIV, fig. 10) be compared with that given by Hansen (1911, text-fig. 8), the closest agreement between the two will be noticed, except for the additional process described by Colosi. Moreover, Colosi had only one specimen of *E. uncinata*, which he found among seventy specimens of *E. lucens*; it seems reasonable, therefore, to regard it as an abnormal male of *E. lucens*.

Distribution.—All the known records of this species are from the southern temperate waters of the globe, north of the isotherm of 12° C., except Sars' "Challenger" record from 51° 35′ S., 65° 39′ W. (surface temperature 48° F. = 9° C.), Hansen's record (1921, p. 6) from the entrance to the Straits of Magellan, and the "Terra Nova" records given above. With regard to Sars' record, it should be noted that Hansen is of the opinion that it ought to be cancelled until further evidence is to hand, in view of the discovery of a very closely allied species, *E. frigida*, with which *E. lucens* is liable to be confused. On the other hand, Colosi (1917) has recorded *E. lucens* from 51° 4′ S., 66° 54′ W., a locality very close to the "Challenger" station, and to judge from his figures, his identification is correct: the surface temperature at this station was, however, 12·4° C. Hansen's record from the Magellan Straits is based on the examination of females only, and the most easily recognized distinguishing character between the two species is to be found in the male copulatory organs. The "Terra Nova" specimens were taken to the south of New Zealand, well south of the isotherm of 12° C., but they appear to agree with *E. lucens* rather than with *E. frigida*. The species may therefore be regarded as essentially a temperate-water form, which may occasionally penetrate into sub-Antarctic waters. It is apparently an epiplanktonic species.

14. *Euphausia frigida*, Hansen.

E. frigida, Hansen, 1911, p. 27, text-fig. 9; Hansen, 1913, p. 30, pl. III, figs. 4*a*–4*b*, pl. IV, figs. 1*a*–1*d*; Zimmer, 1914, p. 427; *Euphausia* sp., Tattersall, 1908, p. 14; *E. splendens*, Calman, 1901, p. 23.

Occurrence.—"Discovery." 46° 55′ S., 70° 15′ E., twenty specimens. 51° 40′ 30″ S., 116° 59′ E., fifty specimens.

Distribution.—All the specimens of this species so far recorded are from localities within the isotherm of 12° C. and outside the limits of pack-ice, except Zimmer's record (1914) from 58° 29′ S., 89° 58′ E., which is well within the Antarctic zone proper. The species may therefore be regarded as a true sub-Antarctic form. It has been recorded from the surface on two occasions (Hansen, 1913), and the present material is likewise from surface gatherings.

15. *Euphausia vallentini*, Stebbing.

E. vallentini, Stebbing, 1900, p. 545, pl. XXXVII; Tattersall, 1908, p. 13, pl. IV, figs. 4–6; Hansen, 1913, p. 32, pl. V, figs. 1*a*–1*f*; *E. splendens* (pars), G. O. Sars, 1885, p. 80, pl. XIII, figs. 7–17; *E. patachonica*, Colosi, 1917, p. 187, pl. XIV, figs. 11–14, pl. XV, figs. 15–20.

Occurrence.—"Terra Nova." Sub-Antarctic zone. Stations 235–241, thirty specimens, 8–22 mm.

"Discovery."—46° 55′ S., 70° 15′ E., three males, four females; 51° 40′ 30″ S., 116° 59′ E., two immature females.

Remarks.—*Euphausia patachonica*, recently described by Colosi from off the south of Patagonia, may be only an immature or non-breeding phase of this species. It differs from *E. vallentini* in the absence of a spine on the dorsal surface of the third abdominal somite and in the form of the copulatory organs of the male. As to the first character, both Hansen (1911) and I (1908) have called attention to specimens of *E. vallentini* in which the spine on the third abdominal somite was wanting. As to the male pleopods, Colosi's figures appear to me to have been taken from an immature specimen before the final moult. It is true that the size of Colosi's specimens, 21–23 mm., is larger than any hitherto recorded, but there is a comparatively enormous range in the size of mature Euphausians. They probably become sexually mature before attaining their maximum size, and we have no information as to what form the copulatory organs take in the moult subsequent to the attainment of sexual maturity. It is possible that changes analogous to those described in *Cambarus* and *Pandalus* accompany growth after sexual maturity has been reached, that there are, in fact, definite high and low, breeding and non-breeding phases. Hence I suggest that Colosi's specimens were either immature or in the non-breeding phase. The form of the copulatory organs may be an excellent specific character when combined with other differences, but it is a little dangerous to rely upon it alone to separate species, as the changes which accompany growth are so little known.

Distribution.—All the known records of this species, with four exceptions, are from localities within (south of) the mean annual isotherm of 12° C., i. e. in the sub-Antarctic zone. One of them, indeed (Zimmer, 1914), is actually from within the limits of floating ice and therefore truly Antarctic (58° 29′ S., 89° 58′ E.). The four exceptional records are (1) "Challenger," 40° 3′ S., 132° 58′ W., South Pacific; (2) Hansen (1911 and 1913), 32° 15′ S., 50° 14′ W.; and (3 and 4) Zimmer (1915), 38° S., 53° W., and 42° S., 62° W. Hansen's and Zimmer's records are from off the east coast of South America, and Hansen remarks in explanation of his records "the map shows that a branch from the Antarctic Cape Horn current runs in a north-eastern direction east of South America at least to near Lat. 32° S." In this region there seems to be a mingling of the south temperate and sub-Antarctic pelagic faunas. We are justified, I think, in regarding *E. vallentini* as a true sub-Antarctic species penetrating to south temperate regions under certain conditions. The species appears

to be on the whole a surface and upper-water form. Stebbing's types were caught by surface tow-netting in Stanley Harbour, Falkland Islands, the "Challenger" specimen was taken at the surface, and the specimens from no fewer than eleven of the fifteen records from the "Belgica" report were from surface gatherings. None of the "Terra Nova" specimens was from a greater depth than 80 metres.

16. *Euphausia hemigibba*, Hansen.

E. hemigibba, Hansen, 1910, p. 100, pl. XIV, figs. 5*a*–5*f*; *E. gibba*, Lo Bianco, 1901, 1903, 1909; Thiele, 1905; Tattersall, 1909; *E. pseudogibba*, Ortmann, 1905.

Occurrence.—Atlantic Ocean. Stations 45, 46, 49, 65, 68, 69. Twenty specimens, up to 12 mm. in length.

Distribution.—Widely distributed in the sub-tropical and tropical waters of the Atlantic from 42° N. to 36° 27′ 30″ S., 2° 33′ E. to 70° 50′ W. (Hansen, 1912, 1913, 1915; Tattersall, 1913; Zimmer, 1914; Bigelow, 1917). Indian Ocean (Tattersall, 1911; Hansen, 1912). China Sea (Hansen, 1916). Pacific Ocean, near Hawaii (Ortmann, 1905). Mediterranean (Lo Bianco, 1901, 1903, 1909; Thiele, 1905; Tattersall, 1909; Colosi, 1916, 1917, 1922; Zimmer, 1915). The species is essentially a tropical and sub-tropical form. It has only been taken at the surface on two occasions (Tattersall, 1911; and Hansen, 1915). The majority of the records are from deeper waters, some from as much as 3,000 metres.

17. *Euphausia longirostris*, Hansen. [Pl. I, figs. 1–7; pl. II, figs. 1–4.]

E. longirostris, Hansen, 1908, p. 4, pl. I, figs. 1*a*–1*c*; Hansen, 1911, p. 35; Hansen, 1913, p. 35, pl. V, figs. 3*a*–3*d*; Tattersall, 1913, p. 877; Zimmer, 1914, p. 429, pl. XXVI, figs. 65–66; *Euphausia*, sp., G. O. Sars, 1885, p. 170, pl. XXXI, figs. 30–31 (larva).

Occurrence. Sub-Antarctic zone. Stations 235–241. Two adult and twenty-three larvæ in all stages from the first *Furcilia* larva to the post-larval form, 4–17 mm.

Remarks.—The material provides an interesting series of larvæ illustrating the later life-history of the species. The larvæ themselves present several features of interest, and their study has thrown light on a hitherto unknown Euphausian larva described from the "Challenger" collections, and on the possible affinities of *Euphausia schotti*, Ortmann. It seems useful, therefore, to describe the stages in some detail. The material contains specimens of the following larval stages, *Furcilia* (five growth stages), *Cyrtopia* (three stages), and one post-larval. They will be described in that order.

Furcilia larva.—Stage 1. Length, 4 mm. One specimen. (Plate I, fig. 1.)

This larva is essentially at the same stage of development as that figured by Sars in the "Challenger" report (Pl. XXIX, fig. 5), but differs from it in the following points: (1) It is much larger in size. (2) The spine on the outer distal corner of the basal joint of the antennules is quite as long as the rest of the peduncle. (3) The front margin of the rostral plate is smooth. (4) There is a small, wing-like expansion of the lateral

portion of the tergum on each side of the first abdominal somite. (5) The inner of the three long spines at each corner of the apex of the telson is the longest; this is, perhaps, only an individual variation and does not hold for later stages. The posterior dorsal median spine on the carapace is very long, equal in length to the first two somites of the abdomen. There is no dorsal spine on the third abdominal somite, and the lateral and front margins of the carapace and rostral plate are quite smooth and devoid of the spines and teeth so characteristic of the later stages. The first pair of pleopods are present as buds, and the last pair of thoracic and the first abdominal luminous organs are developed. The posterior lateral margins of the sixth abdominal somite are produced backwards, as short spiniform processes.

This larva is so strikingly different from the later stages described below that I hesitated for a long time before including it in the series. I do so for the following reasons: (1) It was found with the other stages. (2) Its large size compared with other *Furcilia* larvæ at the same stage of development suggests that it belongs to a large species of the genus; it falls in quite well with the later stages in the matter of size correlated with degree of development. (3) The curious wing-like projections on the first abdominal somite are exactly like those found in the later stages: I do not remember to have seen these structures before, nor can I find any reference to them in published descriptions or figures.

Stage 2. Length, 4·5 mm. One specimen.

This stage differs from the first in the following points: (1) The rostral plate is more expanded, especially laterally, so that the compound eyes are almost completely covered; its anterior margin is slightly emarginate, and the anterior and lateral margins are coarsely dentate. (2) The lateral margins of the carapace are likewise coarsely toothed: the antero-lateral spine is very prominent, but there is no posterior lateral spine present as yet. (3) There is a small median dorsal spine on the third abdominal somite. (4) The lower and hind free margins of the abdominal somites are finely serrate. The posterior median dorsal spine of the carapace is as long as the first three somites of the abdomen. The wing-like expansions on the first abdominal somite are very conspicuous. The telson is almost exactly as figured by Sars for the larva on pl. XXIX, fig. 5, of the "Challenger" report. The antennular spine is longer than the rest of the peduncle, and the lateral spiniform projections of the postero-lateral margin of the sixth abdominal somite are very long and prominent. The so-called dorsal organ is present as a small, high cone.

This larva shows all the characteristic features which definitely distinguish the larvæ of *E. longirostris* from other known forms. These features are: (1) the coarse denticulation of the whole of the margins of the carapace and rostral plate; (2) the fine serrations of the free margins of the abdominal somites; (3) the presence of a spine on the third abdominal somite; (4) the greatly developed posterior median dorsal spine of the carapace; (5) the wing-like expansions on the first abdominal somite; (6) the great length of the antennular spine.

Stage 3. Length, 5 mm. One specimen. (Plate I, figs. 2–3.)

This stage agrees with the last in all its essential points, but exhibits the following differences: (1) The central tooth of the anterior margin of the rostral plate is somewhat longer, stouter, and more prominent than the remainder; it foreshadows the future rostral spine. (2) There is now developed a distinct lateral spine on the lower margin of the carapace near the posterior end; this marks the future lateral spine of the adult. (3) The spine on the third abdominal somite is longer and more prominent and the postero-lateral spiniform projections of the sixth abdominal somite are more developed. The first pleopods are fully formed, and the second to the fourth are present as buds. The larva resembles Stage 2 in all other features. The larva described by Sars in his "Challenger" report, p. 170, and figured on pl. XXXI, figs. 30–31, agrees in all its essential points with this stage in the life-history of *E. longirostris*, and I have no hesitation in identifying it as such: the place at which it was captured (Southern Ocean, off Prince Edward Island) is well within the area of the known distribution of the species.

Stage 4. Length, 6·25 mm. Four specimens.

First four pleopods fully developed and the fifth pair present as buds.

The rostral spine is now well marked, but is still short. The margins of the rostral plate and the anterior half of the lateral margins of the carapace still retain their coarse denticulation, but the teeth have disappeared from the posterior half of the margin of the carapace (except, of course, the lateral spine of the carapace characteristic of the species) and the serrations of the abdominal somites are almost obsolete. The remaining parts have developed in quite the normal way.

Stage 5. Length, 6·75 mm. One specimen.

First four pleopods fully developed, fifth pair with one or two terminal setae.

All the luminous organs and four thoracic limbs are present. The rostral spine now reaches the distal end of the first joint of the antennular peduncle. The lateral parts of the rostral plate are still somewhat expanded over the eyes as hoods with toothed margins, and there is still a trace of teeth on the lateral margins of the carapace. The posterior median dorsal spine of the carapace reaches its maximum development at this stage and is as long as the first three abdominal somites. The flagella of the antennules have become somewhat elongated and are divided up into several joints.

Stage 6. Length, 7·25 mm. Eight specimens. (Plate I, figs. 4–5, Plate II, fig. 1.)

All the pleopods and luminous organs are developed, but the antennae are still natatory as in the *Furcilia* stage. The flagella of the antennules are greatly elongate and multi-articulate, more like those of the *Cyrtopia* stage. The rostral spine extends nearly to the end of the second joint of the antennular peduncle and the margins of the rostral plate are still dentate. Traces of teeth are still to be found on the lateral margins of the carapace. The posterior median dorsal spine of the carapace is

somewhat shorter than in the last stage, only as long as the first two segments of the abdomen ; from this stage onwards it shows a progressive shortening until its final disappearance in the post-larval stages. The median dorsal spine on the third pleon segment is as long as the segment itself. The telson is exactly like that of the last *Furcilia* larva figured in the " Challenger " report, pl. XXX, fig. 40.

Cyrtopia Larva. Stage 1. Length, 8 mm. Four specimens.

Five spinules on the produced portion of the apex of the telson.

Stage 2. Length, 8·5 mm. One specimen. (Plate I, fig. 6–7, Plate II, fig. 2.)

Three spinules on the produced apex of the telson.

Stage 3. Length, 9 mm. One specimen.

The telson has assumed the adult form.

The *Cyrtopia* larva is characterized by the change in form of the antennæ, from purely natatory appendages to those having the structure and function of the adult. At the same time the posterior margin of the apex of the telson between the large pair of terminal spines becomes produced backwards and gradually assumes the lanciform shape of the adult telson with the consequent gradual loss of the spinules, seven in number, characteristic of the *Furcilia* larva.

In the oldest *Cyrtopia* larva in the present collection the rostral spine is as long as the antennular peduncle. The lateral margins of the rostral plate are still denticulate and the plate is expanded laterally. The posterior spine of the carapace is considerably shorter than in the *Furcilia* stage and is only equal in length to the first abdominal somite. The spine on the third abdominal somite, on the other hand, has retained its proportions, and there are slight acuminations on the fourth and fifth segments, the beginnings of the spines characteristic of the fully adult animal. The antennular spine is commencing to shorten and the antennal scale extends to the distal end of the second joint of the antennular peduncle.

Post-larval stage. (Plate II, fig. 3.) Length, 12·5 mm. One specimen.

In spite of its large size, this specimen still retains traces of two larval characters. The rostral plate is expanded as a hood over the bases of the eyes and its margins are denticulate. The antennular spine, though much shorter than in the last *Cyrtopia* stage, is still large and prominent ; the large supra-ocular spine on the carapace of the adult is consequently not yet developed, but the other parts of the body and its appendages have assumed the adult form, even the leaflet on the antennule being fully developed. The telson shows two dorso-lateral ridges, with a series of five spines on the posterior half of each. The dorsal organ, which is present as a prominent conical process on the dorsal surface of the carapace all through the larval life, persists in the adult. The posterior median dorsal spine of the carapace has completely disappeared.

The characteristic features of the life-history of *E. longirostris* are the greatly prolonged larval life and the distinctive armature of the body at all stages. Fully

adult form is not reached until a length of almost 15 mm. is attained. The two largest specimens in the collection measure 17 mm. and appear to be completely adult in all their characters. The wing-like projections on the first abdominal somite, which have been noticed as forming quite a conspicuous feature of the larval stages, persist in the adult as two lateral flaps of integument, not projecting laterally, but folded against the body (Plate II, fig. 4).

Distribution.—The complete list of known records of this species is as follows: "Challenger," 45° 57′ S., 34° 39′ E., Southern Ocean, near Prince Edward Island. 56° 49′ S., 64° 30′ W.; 48° 27′ S., 42° 36′ W.; and 49° 56′ S., 49° 56′ W., Hansen (1908 and 1913). 37° 47′ S., 3° 59′ E., to the S.W. of the Cape (Tattersall, 1913). 43° 4′ S., 36° 22′ E., to the S.E. of the Cape (Zimmer, 1914). With the exception of my own record of 1913, all these records, including those from the present material, refer to localities within the mean annual isotherm of 12° C., and the exceptional record is from a locality quite near to this isotherm. I conclude, therefore, that *E. longirostris* is essentially a sub-Antarctic species of circumpolar distribution.

18. *Euphausia spinifera*, G. O. Sars.

E. spinifera, G. O. Sars, 1885, p. 93, pl. XVI, figs. 9–16; Hansen, 1911, p. 35; Zimmer, 1914, p. 429; *E. schotti*, Ortmann, 1893, p. 13, pl. VII, fig. 8; Hansen, 1910, p. 89.

Occurrence.—"Terra Nova." North of New Zealand. Station 127, one larva, second *Furcilia* stage, 5·5 mm.

"Discovery." 40° 12′ 30″ S., 32° 27′ 30″ E., 19.10.01, three larvæ, second *Furcilia* stage, 5 mm.; last *Cyrtopia* stage, 7·5 mm.; and post-larval stage, 8·5 mm.

Remarks.—These larvæ differ from those of *E. longirostris* just described (1) in size, and (2) in the absence of denticulations on the lateral margins of the carapace (except, of course, the lateral spine, present in the early stages and persisting in the adult). The abdominal somites are not serrated. The difference in size can best be shown in a short comparative table:

	E. spinifera.	*E. longirostris.*
Second Furcilia	5·5 mm.	6·25 mm.
Last Cyrtopia	7·5 mm.	9·0 mm.
Post-larval	8·5 mm.	12·5 mm.

E. spinifera, therefore, seems to have a less prolonged larval life than *E. longirostris* and reaches the adult condition at a smaller size, although eventually it attains almost as great a length as the latter. Except for the absence of teeth on the lateral margins of the carapace, the larvæ of *E. spinifera* agree very closely with those of *E. longirostris*. Zimmer (1914) has already suggested that *Euphausia schotti*, Ortmann, represents the post-larval stage of *E. spinifera*, and in this opinion I fully concur. Ortmann does not give any size for his specimen, but from the figure and the magnification given in the explanation of the plates I conclude that it measured

about 8–8·5 mm. The post-larval specimen of this species, measuring 8·5 mm., agrees closely with Ortmann's description and figure of *E. schotti*, and I have little doubt that Zimmer's deduction as to the identity of the latter with *E. spinifera* is correct. Hansen's suggestion that *E. schotti* probably represents the larval stage of a species of *Thysanopoda* cannot, therefore, be sustained. On the other hand, the suggestion made by Zimmer that the Euphausian larva described by Sars in the "Challenger" report, p. 170, pl. XXXI, figs. 30 and 31, also belongs to *E. spinifera*, must be reconsidered in the light of the material here attributed to *E. longirostris*.

Distribution.—The known distribution of this species is as follows: "Challenger." 39° 41′ S., 131° 23′ W., south Pacific; 40° 3′ S., 132° 58′ W., south Pacific; and 48° 18′ S., 130° 11′ E., south of Australia. (The latitude and longitude given in the "Challenger" report (48° 18′ S., 30° 11′ E.) are not south of Australia, but near Prince Edward Island. I presume that the longitude should read 130° 11′ E. It is not possible to verify this either from the "Narrative of the Cruise" or the "Summary of the Results," because on the date given in the "Challenger" report, May 9 and 10, 1874, the "Challenger" was in Sydney Harbour. On March 9 and 10 it was in the neighbourhood of 48° 18′ S., 130° 11′ E.)

Ortmann (1893). 38° 3′ S., 27° 4′ W., south Atlantic.

Hansen (1911). Between 32° 30′ S. and 38° S. in the Atlantic, and between 38° S. and 40° 50′ S. in the Indian Ocean.

Zimmer (1914). 32° 8′ S., 8° 28′ W., south Atlantic, 35° 10′ S., 2° 33′ W., south Atlantic, and 35° 39′ S., 8° 16′ E., south Atlantic.

Including the two localities recorded in this report, all the places at which this species has been captured lie in the southern temperate waters of the Atlantic, Pacific, and Indian Oceans, with the exception of the "Challenger" record to the south of Australia, which lies in the sub-Antarctic zone, i. e. between the isotherms of 12° C. and 6° C. The species may, I think, be regarded as essentially a southern temperate form, with *E. longirostris* as its sub-Antarctic representative.

Genus THYSANOËSSA, Brandt.

19. *Thysanoëssa gregaria*, G. O. Sars.

T. gregaria, G. O. Sars, 1885, p. 120, pl. XXI, figs. 8–17, pl. XXII; Hansen, 1911, p. 43, fig. 15; Hansen, 1913, p. 37, pl. VI, figs. 1*a*-1*b*; Esterley, 1914, p. 11, pl. I, figs. 5 and 16, pl. II, figs. 24 and 31.

Occurrence.—North of New Zealand. Occurred in twenty gatherings made in this area. The largest specimens measured 16 mm.

Distribution.—Of wide distribution in the waters of the North and South Temperate Zones, but rarely found in tropical waters. It has been recorded from

Australian and New Zealand waters by the "Challenger" and from the Kermadec Islands by Chilton (1911).

20. *Thysanoëssa macrura*, G. O. Sars.

T. macrura, G. O. Sars, 1885, p. 125, pl. XXIII, figs. 1–4; Tattersall, 1908, p. 17, pl. III, figs. 1–12; Hansen, 1908, p. 5, pl. I, figs. 2*a*–2*h*; Hansen, 1913, p. 40, pl. VI, figs. 3*a*–3*h*.

Occurrence.—Antarctic zone. Stations 267, 269, 270, 272, 274, 275, 282, 285, 289, 290, 317, 337, 342, 345, about seven hundred and fifty specimens altogether, the largest of which measured 25 mm. About seven hundred of these occurred in one haul, viz. Station 269.

Distribution.—All the records of this species are from south of the isotherm of 12° C. except one of the "Challenger" records, from 37° 17′ S., 53° 52′ W. The species is therefore essentially an Antarctic and sub-Antarctic form.

21. *Thysanoëssa vicina*, Hansen.

T. vicina, Hansen, 1911, p. 45, text-figs. 16*a*–16*b*; Hansen, 1913, p. 38, pl. VI, figs. 2*a*–2*k*; Zimmer, 1914, p. 431.

Occurrence.—"Terra Nova." Station 167, one female; Stations 235–241, very many of both sexes.

"Discovery." 40° 12′ 30″ S., 32° 27′ 30″ E., thirteen specimens. 51° 40′ 30″ S., 116° 59′ E., few.

Distribution.—All the records of this species are from the waters between the limit of pack-ice and the isotherm of 12° C. It is therefore a true sub-Antarctic species. Station 167 appears to be on the border line between the Antarctic and sub-Antarctic zones.

21 *a*. *Thysanoëssa* sp.

Large numbers of immature *Thysanoëssa* occurred at Stations 251, 259, 298, and 300. These may belong either to *T. vicina* or to *T. macrura*, but are too young to determine with certainty.

Genus NEMATOSCELIS, G. O. Sars.

22. *Nematoscelis ? microps*, G. O. Sars.

Occurrence.—Atlantic Ocean. Station 43 and 68, twelve immature specimens. North of New Zealand. Stations 80, 87, 127, 132, 136, about thirty specimens, all immature, none exceeding 12 mm. in length.

Remarks.—None of these specimens is adult, and therefore none can be identified with certainty. I believe they represent the young stages of *N. microps*, a species widely distributed in the tropical and sub-tropical waters of the world. The genus has not been recorded from New Zealand waters before. Nearly all the specimens were caught at the surface at night.

GENUS NEMATOBRACHION, Calman.

23. *Nematobrachion flexipes*, Ortmann.

Stylocheiron flexipes, Ortmann, 1893, p. 18, pl. I, fig. 7 ; Ortmann, 1894, p. 105 ; *Nematodactylus flexipes*, Calman, 1896 ; *Nematobrachion flexipes*, Hansen, 1905 (2), p. 32 ; Hansen, 1910, p. 112 ; Tattersall, 1911, p. 133 ; Hansen, 1912, p. 269, pl. X, figs. 5*a*–5*m* ; Zimmer, 1914, p. 534 ; Hansen, 1915, p. 110 ; Hansen, 1916, p. 651.

Occurrence.—North of New Zealand. Stations 80, 92, 93, and 106, six specimens, three at 7 mm., one at 9 mm., one at 11 mm., and one at 12 mm.

Remarks.—None of these specimens is more than half grown, but I feel there is no doubt as to their identity. In the three larger specimens the characteristic spines on the abdominal somites are present ; in the three smaller ones only the spine on the sixth abdominal somite is clearly present. Only one of these specimens has the characteristic elongate leg of the genus with the curious abrupt bend or kink in the proximal portion of the fourth joint, but all have a prominent spine on the lateral margin of the carapace, and thereby present a feature not yet observed in the genus. Indeed, Hansen, speaking of this very species, says (1912, p. 271), "It may be mentioned here that even in less than half-grown specimens the carapace has no vestige of any tooth on the lateral margins." I have re-examined one of the specimens recorded by me from the Indian Ocean in 1911, the larger of the two, measuring 11 mm., and I find it also has a well-marked spine on the lateral margin of the carapace. *N. flexipes* therefore agrees with certain species of the genus *Nematoscelis* in possessing a lateral spine on the carapace in the larval and post-larval stages but in lacking a spine in the adults.

Distribution.—Tropical Atlantic, south Equatorial Current, Ortmann (1893) ; Gulf of Panama, Ortmann (1894) ; Indian Ocean near the Seychelles, Tattersall (1911) ; several localities in the east tropical Pacific, and two localities in the tropical Atlantic, Hansen (1912) ; several stations in the tropical Atlantic, Zimmer (1914) ; four stations near the Philippines, Hansen (1916). The present records therefore extend its known range in the Pacific, and are the first for the waters of New Zealand. The specimens from the last three "Terra Nova" stations were taken at the surface at night, and the one from Station 80 in a net lowered to 100 metres, the gathering being made just before dusk. Hansen notes the occurrence of the species at the surface on two occasions in the Atlantic and observes that such occurrences must be rare. It may be added that they probably occur only when the animals are in the larval and immature stages.

GENUS STYLOCHEIRON, G. O. Sars.

24. *Stylocheiron carinatum*, G. O. Sars.

S. carinatum, G. O. Sars, 1885, p. 137, pl. XXVI ; Hansen, 1910, p. 113, pl. XVI, figs. 1*a*–1*h* ; Hansen, 1912, p. 274, pl. XI, figs. 2*a*–2*b*.

Occurrence.—North Atlantic. Stations 43, 46, 47, 49, 62, 68, twenty-three

specimens. North of New Zealand. Stations 87, 107, 127, 132, and 136, sixteen specimens, the largest of which measured 8 mm.

Remarks.—All the Atlantic specimens were caught at the surface at night, and in the New Zealand area none of the nets in which it occurred was fishing at greater depths than 30 metres. So far as I am aware the species has not been recorded from the waters of New Zealand before.

Colosi (1917) has recently described a new species, *S. armatum* (by an error called *S. uncinatum* on p. 169 of his paper), closely allied to *S. carinatum* and, in Colosi's opinion, confused with that species by earlier authors. The differences lie in the form of the elongate leg and the structure of the copulatory organs of the male. Unfortunately the elongate legs are missing in most of my specimens, including the only adult male. I feel, therefore, somewhat doubtful about the identity of my specimens. The male appears to agree with *S. armatum* in the structure of the copulatory organs, but such of the specimens as still retain the elongate legs have them of the form ascribed to *S. carinatum* by Colosi. It is possible that both species are present in the collection.

Distribution.—*S. carinatum* is widely distributed in the upper waters of the tropical and sub-tropical oceans. *S. armatum* has so far only been detected in material from the Caribbean Sea and Indian Ocean.

25. *Stylocheiron suhmii*, G. O. Sars.

S. suhmii, G. O. Sars, 1885, p. 142, pl. XXVII, figs. 1–4; Hansen, 1912, p. 277, pl. XI, figs. 3*a*–3*b*.

Occurrence.—North Atlantic. Station 68, fifteen specimens. North of New Zealand. Station 83, one male; Station 135, two immature.

Remarks.—The species is new to the waters of New Zealand. The majority of the specimens are immature and were captured at the surface at night. The male specimen is apparently mature and was caught at a depth of 2 metres.

Distribution.—Widely distributed in the tropical and sub-tropical waters of the world.

26. *Stylocheiron longicorne*, G. O. Sars.

S. longicorne, G. O. Sars, 1885, p. 144, pl. XXVII, fig. 5; Hansen, 1910, p. 120, pl. XVI, figs. 5*a*–5*b*; 1912, p. 279, pl. XI, figs. 4*a*–4*b*.

Occurrence.—North of New Zealand. Stations 120 and 130, one specimen in each.

Remarks.—Both specimens were taken at the surface at night. The species is new to the oceanic waters round New Zealand.

Distribution.—Widely distributed in the tropical and sub-tropical waters of the world.

27. *Stylocheiron abbreviatum*, G. O. Sars.

S. abbreviatum, G. O. Sars, 1885, p. 147, pl. XXVII, figs. 12–13 ; Hansen, 1912, p. 280, pl. XI, figs. 5*a*–5*d*.

Occurrence.—North Atlantic. Station 70, one specimen. North of New Zealand. Stations 80, 86, 92, 127, 136, about twenty specimens, the largest of which measured 10 mm.

Remarks.—The specimens are all immature, but I think they may definitely be referred to this species. All the specimens were taken at night except those from Station 80. Those from the last three stations were caught at the surface, and none of the nets was fishing deeper than 100 metres.

Distribution.—Widely distributed in tropical and sub-tropical waters. The species is new to the fauna of New Zealand.

27 *a*. *Stylocheiron* sp.

Occurrence.—"Terra Nova." Sub-Antarctic zone. Stations 235–241, three larvæ.

"Discovery." 40° 12′ 30″ S., 32° 27′ 30″ E., one larva.

Remarks.—These specimens belong to the *S. abbreviatum* group and are probably the larval stages of *S. maximum*, Hansen, a species known to extend into the sub-Antarctic zone (Hansen, 1913, p. 44).

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VI.—INDEX.

abbreviatum, Stylocheiron, 2, 5, 6, 8, 31.
aequalis, Thysanopoda, 2, 15.
americana, Euphausia, 2, 17.
antarctica, Euphausia, 18.
armata, Euphausia similis var., 4, 5, 6, 8, 19.
armatum, Stylocheiron, 30.
australis, Euphausia, 18.
,, Nyctiphanes, 4, 5, 6, 7, 16.

Bentheuphausia, 2, 9.
bidentata, Euphausia, 17.
brevis, Euphausia, 2, 17.

capensis, Nyctiphanes, 16.
carinatum, Stylocheiron, 2, 5, 6, 8, 29.
couchii, Nyctiphanes, 3.
crystallorophias, Euphausia, 9, 10, 19.

Euphausia, 2, 10, 17, 22.
,, americana, 2, 17.
,, antarctica, 18.
,, australis, 18.
,, bidentata, 17.
,, brevis, 2, 17.
,, crystallorophias, 9, 10, 19.
,, frigida, 9, 10, 20.
,, gibba, 22.
,, glacialis, 18.
,, gracilis, 4, 18.
,, hemigibba, 2, 22.
,, krohnii, 3.
,, longirostris, 9, 22.
,, lucens, 4, 5, 9, 19.
,, murrayi, 18.
,, pacifica, 3.
,, patachonica, 21.
,, pellucida, 4, 17.
,, pseudogibba, 22.
,, recurva, 4, 5, 6, 7, 16, 17.
,, schotti, 22, 26.
,, similis, 9, 18.
,, ,, var. armata, 4, 5, 6, 8, 19.
,, ,, ,, lobata, 19.
,, spinifera, 4, 5, 6, 8, 9, 26.
,, splendens, 19, 20, 21.
,, superba, 9, 10, 18.
,, tenera, 2, 4, 5, 18.
,, triacantha, 9, 10.
,, uncinata, 19, 20.
,, vallentini, 9, 10, 21.

flexipes, Nematobrachion, 5, 6, 8, 29.
,, Nematodactylus, 29.
,, Stylocheiron, 29.
frigida, Euphausia, 9, 10, 20.

gibba, Euphausia, 22.
glacialis, Euphausia, 18.
gracilis, Euphausia, 4, 18.
gregaria, Thysanoëssa, 4, 5, 6, 7, 27.

hemigibba, Euphausia, 2, 22.

inermis, Thysanoëssa, 3.

krohnii, Euphausia, 3.

latifrons, Pseudeuphausia, 4, 5.
lobata, Euphausia similis var., 19.
longicorne, Stylocheiron, 5, 6, 8, 30.
longirostris, Euphausia, 9, 22.
lucens, Euphausia, 4, 5, 9, 19.

macrura, Thysanoëssa, 9, 28.
maximum, Stylocheiron, 9, 31.
megalops, Nematoscelis, 3.
,, Thysanopoda, 19.
Meganyctiphanes, 9.
,, norvegica, 3.
microphthalma, Thysanopoda, 15.
microps, Nematoscelis, 2, 5, 6, 8, 28.
murrayi, Euphausia, 18.

Nematobrachion, 2, 9, 29.
,, flexipes, 5, 6, 8, 29.
Nematodactylus flexipes, 29.
Nematoscelis, 2, 9, 28.
,, megalops, 3.
,, microps, 2, 5, 6, 8, 28.
norvegica, Meganyctiphanes, 3.
Nyctiphanes, 9, 16.
,, australis, 4, 5, 6, 7, 16.
,, capensis, 16.
,, couchii, 3.
,, simplex, 3, 16.

obtusifrons, Thysanopoda, 5, 6, 8, 15, 16.

pacifica, Euphausia, 3.
patachonica, Euphausia, 21.
pellucida, Euphausia, 4, 17.
Pseudeuphausia, 9.
,, latifrons, 4, 5.
pseudogibba, Euphausia, 22.

recurva, Euphausia, 4, 5, 6, 7, 16, 17.

schotti, Euphausia, 22, 26.
similis, Euphausia, 9, 18.
similis var. armata, Euphausia, 4, 5, 6, 8, 19.
,, ,, lobata, Euphausia, 19.
simplex, Nyctiphanes, 3, 16.
spinifera, Euphausia, 4, 5, 6, 8, 9, 26.
splendens, Euphausia, 19, 20, 21.
Stylocheiron, 1, 9, 29, 31.

Stylocheiron abbreviatum, 2, 5, 6, 8, 31.
,, armatum, 30.
,, carinatum, 2, 5, 6, 8, 29.
,, flexipes, 29.
,, longicorne, 5, 6, 8, 30.
,, maximum, 9, 31.
,, suhmii, 2, 5, 6, 8, 30.
,, uncinatum, 30.
suhmii, Stylocheiron, 2, 5, 6, 8, 30.
superba, Euphausia, 9, 10, 18.

tenera, Euphausia, 2, 4, 5, 18.
Tessarobrachion, 9.
Thysanoëssa, 10, 27, 28.
,, gregaria, 4, 5, 6, 7, 27.
,, inermis, 3.
,, macrura, 9, 28.
Thysanoëssa vicina, 9, 28.
Thysanopoda, 1, 9, 14, 27.
,, aequalis, 2, 15.
,, megalops, 19.
,, microphthalma, 15.
,, obtusifrons, 5, 6, 8, 15, 16.
,, tricuspidata, 2, 14.
,, vulgaris, 16.
triacantha, Euphausia, 9, 10.
tricuspidata, Thysanopoda, 2, 14.

uncinata, Euphausia, 19, 20.
uncinatum, Stylocheiron, 30.

vallentini, Euphausia, 9, 10, 21.
vicina, Thysanoëssa, 9, 28.
vulgaris, Thysanopoda, 16.

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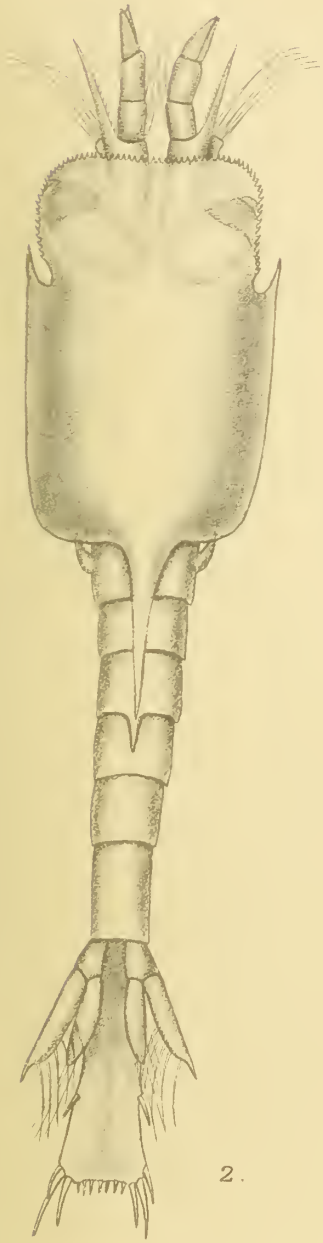
PLATE I.

Euphausia longirostris, Hansen.

FIG. 1.—*Furcilia* larva, stage 1, dorsal view. × 25.
FIG. 2.—*Furcilia* larva, stage 3, dorsal view. × 25.
FIG. 3.—*Furcilia* larva, stage 3, lateral view. × 25.
FIG. 4.—*Furcilia* larva, stage 6, dorsal view of anterior end. × 25.
FIG. 5.—*Furcilia* larva, stage 6, telson and uropods. × 25.
FIG. 6.—*Cyrtopia* larva, stage 2, third abdominal somite, showing the development of the median dorsal spine. × 25.
FIG. 7.—*Cyrtopia* larva, stage 2, telson and uropods. × 25.



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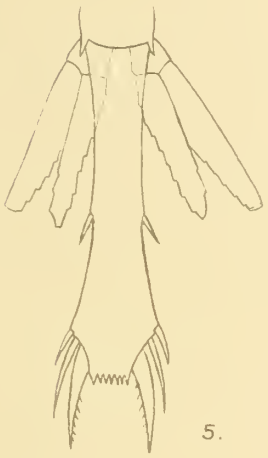

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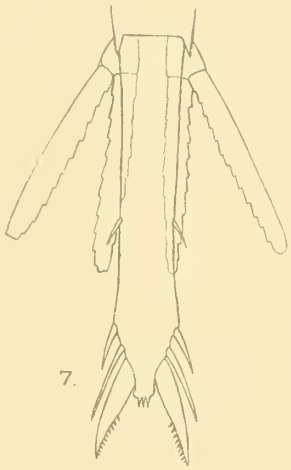

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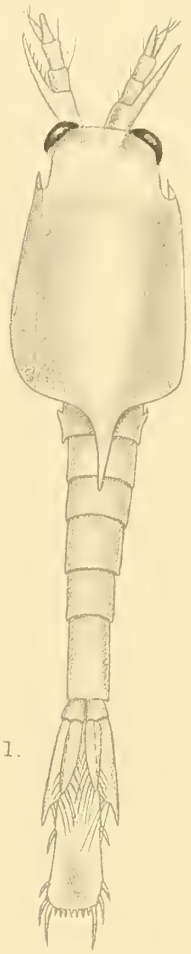

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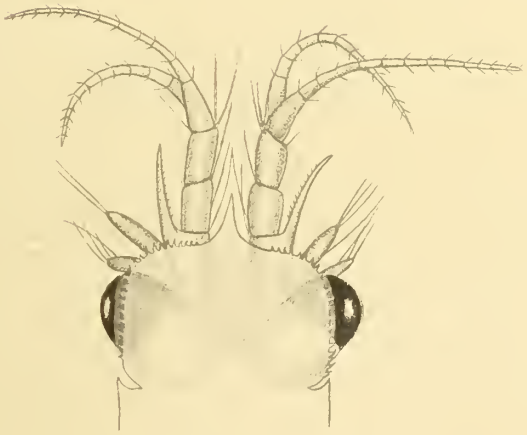

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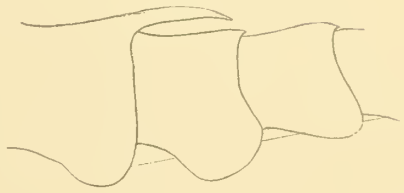

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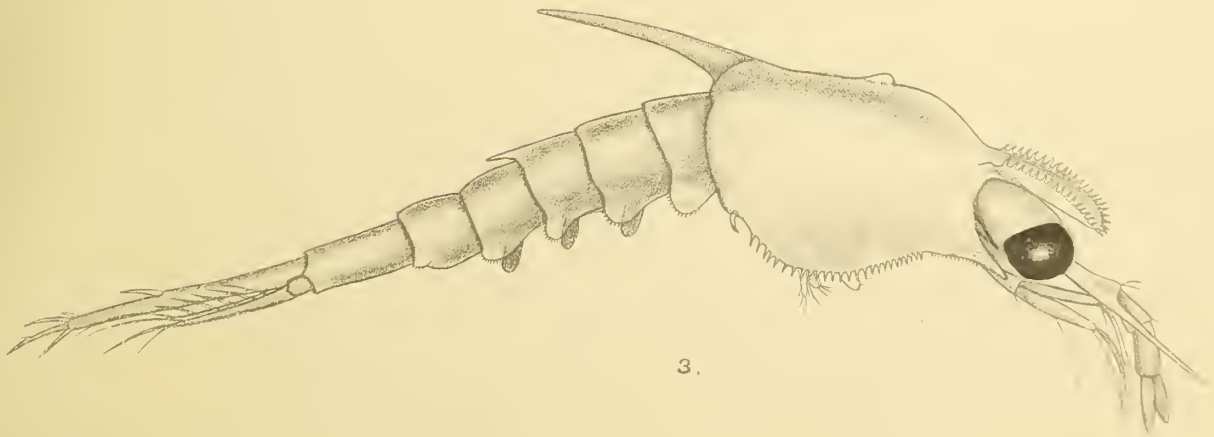

3.

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PLATE II.

Euphausia longirostris, Hansen.

Fig. 1.—*Furcilia* larva, stage 6, lateral view. × 25.
Fig. 2.—*Cyrtopia* larva, stage 2, dorsal view of anterior end. × 25.
Fig. 3.—Post-larval stage, dorsal view of anterior end. × 25.
Fig. 4.—Adult stage, lateral view of the first abdominal somite, to show the lamellar projection on the anterior margin, the remains of the wing-like projections of the larval stages.

Thysanopoda aequalis, Hansen.

Fig. 5.—Third thoracic limb of the male. × 22.
Fig. 6.—Third thoracic limb of the female. × 22.

1
2
3
4
5
6

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BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910.

NATURAL HISTORY REPORT.

ZOOLOGY VOL. VIII. No. 2 Pp. 57–202.

CRUSTACEA.

PART IX.—DECAPOD LARVAL

BY

ROBERT GURNEY M.A., F.L.S.

WITH APPENDIX AND FIGURES IN THE TEXT.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM.
1924.
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British Museum (Natural History).

This is No. 3. *of* 25 *copies of "Terra Nova" Zoology, Vol. VIII., Crustacea, Part IX., printed on Special paper.*

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16 DEC. 1924

CRUSTACEA.

PART IX.—DECAPOD LARVAE.

BY ROBERT GURNEY, M.A., F.L.S.

WITH 78 FIGURES IN THE TEXT.

	PAGE
I.—Introduction	37
II.—Distribution	38
III.—The Systematic and Phylogenetic Importance of Decapod Larvae.	39
IV.—Classification	44
V.—The Nomenclature of Larval Stages	46
VI.—List of Stations	48
VII.—Descriptions of Larvae	48
VIII.—List of Literature	197
IX.—Index	201

I.—INTRODUCTION.

I AM greatly indebted to Dr. W. T. Calman for the opportunity of examining and reporting on the Decapod larvae collected by the "Terra Nova" Expedition, and for much help and encouragement in the carrying out of the work. Many of the larvae had already been sorted out from the plankton samples, and the greater part of this work was done by Miss Webb, to whom I wish to express my thanks. I have, however, myself looked through nearly the whole of the samples, since, even when these had already been examined, it was sometimes necessary to make a special search for additional stages of certain larvae. The result of such a careful and repeated inspection has been the gathering together of an extensive material containing larvae representing nearly all the groups of the Decapoda. Nearly all the samples were taken at or near the surface and consequently advanced larvae of deep-sea forms are very rare.

It seldom happens that in plankton material of this kind a series of stages of the same larva is taken which is sufficiently complete to enable the genus to be determined, and only one such case (*Upogebia*) is recorded below. The remainder must be identified as nearly as possible by reference to published descriptions of

larvae whose parentage is known, and such identification must in many cases be very speculative. It is, however, in my opinion, more profitable to refer such larvae to definite genera or families, even if the reference prove eventually to be wrong, than to describe them under generic and specific names of their own as has so often been done. I have therefore avoided describing any larva unless it can with some probability be systematically placed; but I have, on the other hand, described a number of larvae whose approximate position can with some certainty be given in the hope that, in this way, family and generic characters may be established. My object has been to provide from larval characters new material for a satisfactory classification of the group.

Where such a course has been possible I have given a summary of the characters of families based on previously established information and supplemented by the material available from these collections. I do not, of course, claim that the following report can be regarded as in any sense a "monograph of Decapod larvae," but it is, I think, the first attempt that has been made to systematize the available information. Williamson's work (1915) is a most valuable mine of information on the subject, but he has made no attempt to summarize or to draw any conclusions from the facts, and his system of nomenclature is so eccentric as somewhat to detract from the undeniable value of his work.

II.—DISTRIBUTION.

Ortmann, in his account of the Decapoda of the Plankton Expedition (1893), has shown that there is a very close relation between the numbers of Decapod larvae and the proximity of land, indicating that the larvae of the littoral species are not carried out to the open sea to any large extent. The "Terra Nova" collections, so far as they permit conclusions to be drawn, fully confirm Ortmann's result. In these collections Decapod larvae are seldom abundant, but the greatest numbers of individuals and of species were taken, firstly at stations 40 and 43, the former in Rio de Janeiro harbour and the latter some distance to the north of it, and secondly in the waters surrounding Three Kings Islands and at station 148 in the Bay of Islands, New Zealand. At each of the stations 40, 43, and 148 twelve or more species of larvae were taken, which is a very large number. In nearly all the samples from the waters surrounding Three Kings Islands and from Spirits Bay, New Zealand, the variety of Decapod larvae was comparatively large, ranging from five to nine species. The plankton from the Bay of Islands was remarkable for the very extraordinary abundance of these larvae, for the collection contained practically nothing else. I have examined large numbers of plankton samples taken off the east and south coasts of England and have never seen any collection approaching this one in the preponderance of Decapod larvae.

On the other hand, the collections made south of New Zealand were most

unproductive, while those taken near or within the Antarctic Circle were entirely barren. Many of these collections were extremely rich in Copepods and other forms of plankton, but though they were examined with much care and labour not a single Decapod larva was found. A few Euphausiids only represented the higher Crustacea.

It should be noted that a number of plankton samples taken in the North Atlantic were remarkably unproductive, though taken at a season when larvae should have been present in numbers. The explanation probably is that these samples were taken, for the most part, at "full speed."

It seems probable that the larvae of Decapods and Euphausiids are not so much at the mercy of the currents as might be supposed. It is not very unusual to find swarms of the larvae of one species in different stages of development, which seems to indicate a power of keeping together from hatching onwards, or of collecting in a suitable locality. For example, I have met with such a swarm of Zoeas of *Corystes* at Plymouth, while in these "Terra Nova" samples at station 251 great numbers of larvae of one species were taken (see p. 95, *Petalidium*) and the sample from the Bay of Islands may be regarded as a swarm of this kind. Lastly at station 52 the sample, from which other Crustacea were almost absent, contained a quantity of eggs and early larvae of a species of *Euphausia*.

Some species seem to have decided preferences for certain regions, if one may judge from the behaviour of the British species of *Leander*. Quite early stages of the larvae are taken singly or in small numbers near Plymouth Sound, but later stages are exceedingly rare in in-shore waters, although the adults are abundant. But, as the time for transformation approaches, the larvae seek the shore. Sollaud (1916, p. 69) states that they may be found in numbers in pools left between tide-marks in the case of *L. serratus*, and I have myself found larvae of *L. longirostris* in the last stage in estuarine waters, although earlier larvae have never been taken there. Larvae are no doubt frequently carried by currents out of their normal habitat, and Faxon (1879) has given the examples of *Porcellana macrocheles* and *Calappa marmorata* which are sometimes so carried by the Gulf Stream to the shores of New England, but I believe that this is exceptional, and that the larvae for the most part have power to control their movements.

III.—THE SYSTEMATIC AND PHYLOGENETIC IMPORTANCE OF DECAPOD LARVAE.

Of the many authors who have attempted the classification of the Decapoda few have taken the larval stages into consideration, but Boas made use of them to some extent, and Cano drew far-reaching conclusions from his extensive study of Decapod

development, and constructed phylogenetic trees to illustrate his views. Particular attention should, however, be drawn to P. Mayer's work (1877). Mayer attached the greatest importance to the structure of the embryonic and larval telson, and drew conclusions from its study which may be summarized as follows:

(1) The primitive telson was forked.
(2) The Caridea form a group apart from and equivalent to the rest of the Decapoda.
(3) The Loricata, Nephropsidea, Thalassinidea, and Anomura form equal groups in a division opposed as a whole to the Brachyura.

Mayer's work does not seem to have received the consideration it deserved, and it must be admitted that the evidence drawn from these larvae has not had much influence upon existing systems of classification. This is due in part to the very incomplete state of knowledge, but more to a general scepticism as to the value of such evidence.

So long as the Zoea was regarded, as it was regarded by Dohrn, Fritz Müller, and Balfour, as representing an adult phase incorporated in the ontogeny, its structure gave rise to phylogenetic speculations which have now only an historic interest, and did little to advance the classification of the group. On the other hand, since it has been shown by Claus and others that the Zoea cannot be regarded as recapitulating an adult ancestry, there has been a tendency rather to underestimate its phylogenetic significance and to dismiss developmental stages as irrelevant in discussions of classification. This point of view is well expressed by Ortmann (1901, p. 1311) thus: "Sobald wir indessen uns bemühen den genetischen Beziehungen auch nur der grossen Abtheilungen der Decapoden unter sich nachzuforschen, lässt uns die Entwicklungsgeschichte ganz im Stich, ja, sie führt uns auf Irrwege, so dass faktisch hier die Verhältnisse so liegen, dass die Thatsachen der Embryologie und Entwicklungsgeschichte so lange unverständlich blieben bis sie durch die Resultate der vergleichenden *morphologischen* Untersuchungen in die richtige Beleuchtung gerückt wurden." Bouvier (1896), without going so far as Ortmann, regards such evidence as "au dernier rang," partly from the great uniformity among the larvae of different groups, and partly owing to the small number of species of which the development is known. The force of the last objection must be freely admitted. We do know the development of a considerable number of species representing all the larger groups of Decapods, but the proportion to the whole is infinitely small. At the same time I entirely disagree with Ortmann's opinion, and in part with that of Bouvier, and believe that the ontogeny when known is likely to be of the greatest value in classification and should by no means be neglected.

The adult stage is only one phase in the individual cycle, and it is hardly logical to concede to one phase the importance which is denied to another. It is true that in the majority of species the larval stages are passed in conditions totally

unlike those to which the adult is adapted, and that they may therefore be subject, independently of the adult, to adaptive modifications of their own,* and it is conceivable that similar modifications might arise in larvae of unrelated forms and lead to erroneous conclusions as to relationship. We are familiar with such difficulties in the case of the adult, and it is not improbable that there may be cases of convergence among the larvae. At the same time the precautions in the estimation of systematic value of structural features that are applied in the case of the adult can be used. It is obviously unwise to place too much reliance for example on such adaptational structures as may be supposed to affect the floating power of larvae.

Our knowledge of Decapod larvae, limited though it is, all goes to show that the larvae of related groups do have recognizable common characters which are sometimes very striking—e. g. the Phyllosoma of the Scyllaridea. Similarly the Brachyura (excluding the Dromiacea) have a characteristic type of Zoea which is extraordinarily uniform throughout the whole order. In both groups a common type of larva has been inherited unchanged from a common ancestor. These are two particularly striking examples in which the form of the body alone is distinctive, and yet it would readily be agreed that the possession of a Phyllosoma larva would definitely place the adult among the Scyllaridea even if, like *Sacculina*, it possessed none of the characters of its allies.

When, therefore, a structure which is apparently of trivial importance is found to characterize all the larvae of a group, either large or small (e. g. the reduced second seta of the telson of some Reptantia), it would be unreasonable to refuse to recognize it as important evidence of affinity, even if it were not in accordance with the evidence drawn from the structure of the adult.

It is true that structures of this kind distinguishing the larvae of certain groups are few, but the particular examples given below are very definite and striking, and to my mind of a higher order of significance than some of the adult features on which far-reaching systematic conclusions have been based.

These considerations concern only the systematic importance to be attached to the larval phase in individual life history, but the phylogenetic significance of this phase is also a subject of importance about which there has been much difference of opinion. Although Claus's view that the Zoea is a secondarily modified larval form is undoubtedly essentially correct, it should not be interpreted as disposing altogether of the phylogenetic importance of the larva. The view recently so forcibly expounded by Garstang (1922), that larval and embryonic stages recapitulate equivalent stages of ancestral forms and not those adult ancestral forms themselves, may be unreservedly accepted without at the same time denying to these stages significance in discussions of phylogeny.

* None the less, the greatest difference between adult and larva is to be found where both apparently lead the same sort of life (Penaeidea).

To take, for example, the case of the Hermit Crab, which has been claimed by MacBride as an example of true Recapitulation. If the symmetrical post-larval stage of a Pagurid actually recapitulated an adult symmetrical ancestor such as a Galatheid, it must be a stage added to the ontogenetic cycle of the ancestor, and of such an addition there is no evidence here or elsewhere. Stage for stage the larval phases of the Pagurid and the Galatheid (or of the Thalassinid for that matter) are identical in their grade of development, and if there were such an accretion of adult stages in the ontogeny then the ontogentic series would necessarily gain in length or be notably modified in the most evolved forms. And yet the longest series of larval stages is found in some of the most primitive forms, and the normal cycle of the higher Decapods commonly contains the same number of essentially similar stages. The symmetrical post-larval stage of the Pagurid is, in fact, no more than the first post-larval stage of the Galatheid or the Thalassinid. At the same time it is definitely a Pagurid in all respects except its symmetry, and it does not seem to me to matter whether we regard it as representing an adult or an adolescent stage in ancestral history. In this particular instance we do not need any evidence from the larval history to enable us to arrive at the conclusion that the asymmetrical Pagurid must at some period have had a symmetrical ancestor, but, if there were not other evidence of the fact, this symmetrical post-larval stage would suffice under any interpretation of it. For as we see the post-larval stages of allied forms giving rise to symmetrical adults, so it must be evident that the existence of a symmetrical stage in the Pagurid implies a symmetrical ancestral adult.

Primitively development must have been a process of gradual growth, without metamorphosis or transformation, as it is in the Branchiopoda now, and the larva would not be greatly different from the adult in the character of the appendages for example. So, though the Nauplius cannot be regarded as representing an adult ancestral type, it probably does indicate that it originally grew into an adult having a cephalic region with three appendages only, and those appendages of the special nauplius form. I cannot believe that the nauplius appendages, so different as they are from those of existing adults, can have been confined to a larval stage. In this sense, then, one may regard the Nauplius as preserving adult ancestral characters without itself "recapitulating" an adult. No existing Crustacea have retained the characters of such an ancestor either with regard to their appendages or their degree of cephalization, and in all at least two more pairs of appendages have been drawn in and modified in the service of the mouth. The head with five appendages is then, in a sense, a "Neocranium," and is found in some Entomostraca, but in Copepoda and in all Malacostraca (except *Bathynella*) one or more additional somites have been drawn into the head.

It is perhaps permissible to postulate three stages of cephalization—the "Nauplius" stage, with three pairs of appendages; the "Entomostracan" stage, in which two

additional pairs are added; and the "Malacostracan" stage, in which a variable number of thoracic appendages are transformed into maxillipedes.

Any modification of the adult in evolution would be accompanied by modification of the larval and adolescent stages, and abrupt transformation and metamorphosis would occur only when the habit of life of the larva is so divergent from that of the adult that the adult type of appendage becomes unsuitable to larval life and the transition must be a sudden one. Preparation for adult life would necessarily be made as far as possible in the larval period, with the result that the larval stages of Decapoda show not only adaptation to their own conditions of existence, but also modifications which belong more properly to the adult phase. Consequently we should not expect these larvae to represent at all exactly either ancestral larval or adult forms. It may, however, be that the "stages" in metamorphosis indicate, in a much disguised condition, landmarks in the evolution of the group. The series of Nauplius and Protozoea stages of the Penaeidea, modified in some directions in anticipation of the "Decapod grade," preserve some of the characters of the "Archiphyllopod" ancestry of the Decapoda—particularly the great biramous second antenna, the pediform maxillae, and the freedom of the thoracic somites. With the transformation to the Mysis stage development enters suddenly the "Decapod grade" at which the remainder of the Decapoda start their life.

But, though the Zoea of the remaining Decapoda resembles the Mysis stage of the Penaeidea, it may perhaps be more correct to say that, at least in its first stage, and perhaps also up to the fourth, it is in fact a much modified Protozoea. Apart from the remarkable transitory structures seen in the embryonic cuticle, there are certain features of the early free larvae which may be regarded as survivals from a Protozoea. These are:

1. Sessile eyes and nauplius eye.
2. Occasional presence of a "frontal organ."
3. Uniramous first antenna.
4. Jointed exopodite of second antenna and presence of long setae on the endopodite, which has not the character of a flagellum.
5. Occasional trace of an exopodite on the first maxilla.
6. In some forms the second maxillae have a somewhat more pediform character than in later stages.

If this view be justified the great discrepancy between the Penaeid and the typical Decapod development to some extent disappears. There remains a great contrast, but no essential difference. In the Penaeidea the "Decapod grade" is foreshadowed in the last protozoeal stages, but is attained at a profound metamorphosis leading to an animal corresponding to the Mysis stage of Caridea. In the Caridea and remaining Decapoda the "Decapod grade" is attained very much earlier, and the Protozoea is suppressed—consequently there is not so great a metamorphosis at any stage.

IV.—CLASSIFICATION.

In the arrangement and nomenclature of the groups of the Decapoda used in this report I have not followed the course now generally adopted of making a primary division into Natantia and Reptantia, but have simply dealt with the various groups as sections of equal value.* I should not be justified in entering here upon a general discussion of the relationships of the larger groups, founded as they are upon adult characters, but I should say that, in my opinion, the Penaeidea have so many characters in common with the more primitive Reptantia that so fundamental a distinction as is implied by Boas's classification is entirely unjustified. I have given below reasons for the removal of the Stenopidea from association with the Penaeidea and Caridea to a position among the Reptantia, but the relation of the Penaeidea to the Caridea is a matter upon which it is difficult to form a decided opinion. The relation does not seem to be so close as to justify the grouping of the two into a single division opposed to the whole or to any section of the other Decapoda; rather the Caridea seem to be a separate and divergent branch of the Decapod stem preserving some primitive features, but in other respects highly evolved.

On the other hand, the evidence to be drawn from a study of the larvae tends to emphasize the primitive nature of the Caridea, and to this extent their relation to the Penaeidea.

The type of development preserved in the Penaeidea may be taken as approximating to that of the ancestral Decapod, and survival of characters which can be referred to the Protozoea is some evidence of phylogenetic position. There can be no doubt that the embryonic cuticle which is thrown off at or immediately after hatching provides evidence of the structure of a larval stage corresponding to the Penaeid Protozoea which at one time led a free existence in the ancestors of Caridea and Reptantia (see Conn, 1884). This larval cuticle frequently shows a structure of telson and antennae quite different from that of the later larva, and much importance has been attached to these transitory structures by Faxon, Conn, and Mayer. I only wish here to deal with the evidence from the telson. Mayer and others have shown that the telson of the Brachyura, whatever its ultimate form may be in the Zoea, has in the embryo a form which is comparable to the forked telson of the Penaeid Protozoea. It is true that this has been seen only in a few types, such as *Carcinus maenas*, but in other Brachyura intermediate forms of telson may be found which show that the form with two divergent branches is primitive and must at one time have been general. This primitive telson was armed with seven large ciliated spines on each branch, and Mayer

* At the same time the division is convenient and I have, perhaps inconsistently, used the terms rather freely.

found the number 7 + 7 to be so general that he assumed it to be the primitive number both for Brachyura and for Caridea. It is also the number usually found in Penaeid larvae.

Now, though it is true that 7 + 7 is the number almost invariably present in the telson of the Zoea of Caridea, it is a remarkable fact that the number in the embryonic telson is 6 + 6. Apparently neither Faxon, Conn, nor Mayer examined the embryonic telson of any Caridea, but I have done so in a number of species and find the result in all cases the same. The two innermost setae of the later Zoea are always seen to be enclosed in a single envelope.* In respect of this character, and it is unquestionably a character of importance, the Caridea stand in a class apart from all other Decapoda except possibly the Penaeidea in which a formula of 6 + 6 is found in some Protozoeas. How far it is general in that group it is impossible at present to say.

The Caridean Zoea is, in some respects, more primitive than that of the Reptantia, and the embryonic telson is evidently reminiscent of an early form of Protozoea.

Among the Caridea the Hoplophoridae are agreed to be the most primitive. The presence in the larva of a distinct exopodite on the first maxilla (p. 107) is an additional piece of evidence. This is a survival in the Zoea of a protozoeal character which is lost in all other Caridea except the Atyidae, in which a homologous structure has been seen in *Paratya compressa*. The occasional presence of one or more setae in the same position in some other Caridea and Reptantia may probably be regarded as the last vestige of a structure once universal in the protozoeal stage.

The presence and number of exopodites on the legs in the adult are characters of doubtful significance, since all Caridea possess them on some of the legs in the larva and they cannot therefore be regarded as wholly lost in any case. They might well be retained or re-acquired in the adult stage in quite unrelated forms, and they are often retained in a reduced condition in early post-larval life. The presence of a rudimentary exopodite in some species of *Pontophilus* (e. g. *P. abyssi*, Smith) is no doubt an example of the retention of a larval character, for the Crangonidae are in other respects perhaps the most highly evolved family of Caridea.

On the other hand, the presence of an exopodite on the fifth leg in the Pasiphaeidae, Hoplophoridae, some Atyidae and the genus *Discias* cannot be dismissed as insignificant. In all other Caridea this exopodite is lost, even in the larva, and its presence in larva or adult cannot be regarded as other than a primitive character. This would readily be conceded in all cases but that of *Discias*, but this genus presents the difficulty, as Kemp has shown, that it is not in other respects at all primitive. At the same time it cannot be placed in any other family, and it seems most

* Species examined—*Leander* (four species), *Pandalus* (two species), *Hippolyte varians*, *Caridina simoni*, &c.

reasonable to suppose that it has retained its exopodites from the ancestral Caridean stock. But the presence in the larva or retention in the adult of these exopodites, while they may be survivals, are not evidence of relationship to the Penaeidea any more than to the Homaridea or Thalassinidea, in both of which the full number of exopodites may be found.

I have dealt below in the case of the remaining groups with the evidence for systematic relationship to be derived from the larvae, but there is one point with regard to the telson on which something should be said here. Stress has been laid on the reduction of the second seta in the telson of the Thalassinidea and Anomura, but I have not attached importance to a character which might be considered of equal value, namely the presence or absence of a median spine. Such a spine is found in the Euphausiacea, the Homaridea, and in all the Thalassinidea except the Laomediidae and *Upogebia* in its first stage. It is not found in any Caridea, Anomura, Stenopidea, or Brachyura. It is associated with a squarely truncated telson, and it is never found when the telson is in any degree forked, unless the Homarid telson may be regarded as a modification of that type. The fact that such a median spine may be occasionally found among the Penaeidea (see p. 68), in which group a forked telson is apparently characteristic, seems to show that this character may not be of great significance and may be independently acquired.

V.—THE NOMENCLATURE OF LARVAL STAGES.

A number of names, originally founded as generic names for unidentified larvae, have been used to define stages in development, and others have been expressly introduced as general terms for such stages, but the sense in which they have been used has varied so much that they have to a large extent ceased to have any precise meaning. The term Zoea, for instance, has long since lost its original generic significance, and has been used by Claus and others to define certain stages intermediate between the "Protozoea" and the "Mysis" stages, while by others it is used simply in a sense synonymous with the word "Larva." There is, I think, no advantage in attempting to restore to it any precise significance, and it is better that it should be used, if used at all, in the general sense. The term "Protozoea" should, on the other hand, be retained, since in its original sense, as first used by Claus, it defined a stage of particular interest and importance. In its definition, or the definition of any stages in Decapod development, insistence on the actual number of appendages present is apt to lead to restricted or ambiguous application, and the important thing for this particular name is that it should define a certain

"grade" of organization which is indicated by general structure. The three chief characters of the Penaeid Protozoea are :

1. Natatory antennae.
2. Biramous, more or less pediform, maxillae.
3. Thoracic somites not fused with the carapace.

These characters are retained in the Penaeids up to the transformation to the "Mysis" stage, and are found in no other free Decapod larvae. Claus attempted to define in the Penaeids an intermediate Zoea stage, but, as Brooks has pointed out, no clear distinction can be made, and I consider that there is distinct advantage in using the word Protozoea to include all post-Naupliar stages up to the Mysis stage of the Penaeidea. It is entirely wrong to apply it, as Meek has done (1918), to the Zoea of the Brachyura, which has none of the essential characters of the Penaeid larva. No doubt the Penaeid type of development is a primitive type, at one time general, and the protozoeal stage is now for the most part passed through in the egg. It is probably quite correct to regard the peculiar antennae and telson of the embryo of many Decapods as the last vestiges of protozoeal structures, and I have given above certain characters of the free larva which I regard also as surviving traces of the earlier grade.

The term "Mysis stage" is useful, though ill-used. If it is to be retained at all it must certainly not be founded on the presence or number of exopodites, since it is obvious that the last larval stage of a Hoplophorid, for example, is the precise equivalent of the similar stage in either a Crangonid, a Thalassinid, or a Brachyuran. The essential feature they have in common is that all the thoracic appendages have reached their full larval development. As a matter of fact it is impossible really to define a "Mysis stage" in such a way that it can have any precise meaning of general application, and I have, as a rule, avoided its use. The only group in which the term has a really useful meaning is that of the Penaeidea, where there is a profound and sudden transformation from the Protozoea. In the Caridea Protozoea, Zoea, and Mysis so grade into one another that no real distinction is possible, and it is generally better simply to describe development as consisting of certain numbered stages corresponding, as a rule, to as many moults.

Some authors, such as Daday (1907) and Sollaud (1923), have given special names to different stages or phases in development. For instance, Daday calls the first three stages in *Caridina* Euzoea, Mesozoea, and Metazoea and the following stages Protomysis, Mesomysis, and Metamysis. Since the first three stages in the majority of Decapoda are essentially similar no serious objection can be raised to giving them names if desired, but later stages vary so much in number and character that such names can have but little meaning. The terms introduced by Sollaud are only applicable to the Palaemonidae. It seems to me that the introduction of these special terms of restricted meaning serves no useful purpose ; they merely burden the memory and focus attention upon unimportant detail.

VI.—LIST OF STATIONS.

The following list includes only those stations which are actually mentioned in this Report. With the exception of the stations in the Antarctic zone, Decapod larvae were found in the majority of the plankton samples, but it has not been thought necessary to include all these stations in the list.

I. Atlantic.

Station 12. 30° 21′ N., 18° 14′ W.
,, 17. 26° 17′ N., 20° 54′ W.
,, 39. Six miles off mouth of Rio de Janeiro harbour.
,, 40. ,, ,, ,,
,, 43. 22° 6′ S., 39° 40′ W.
,, 45. 21° S., 37° 50′ W.
,, 46. 20° 30′ S., 36° 30′ W.
,, 49. 18° 51′ S., 33° 40′ W.
,, 50. 18° S., 31° 45′ W.
,, 52. 5° S., 27° 15′ W.
,, 61. 2° N., 24° 45′ W.
,, 62. 4° 50′ N., 24° W.
,, 65. 23° 28′ N., 34° 45′ W.
,, 66. 25° 35′ N., 34° 10′ W.
,, 67. ,, ,,
,, 311. 35° 29′ S., 50° 26′ W.

II. Pacific. New Zealand region.

Station 85. From Cape Maria Van Diemen Light, W.N.W. 24 miles.
,, 86. Off Three Kings Islands.
,, 92. From Summit Great King, S. by W. 24 miles.
Station 93. From Summit Great King, S.E. by S. 13 miles.
,, 97. Anchorage, North Cape.
,, 106. From West Island, Three Kings Islands, S.W. 5 miles.
,, 107. ,, ,, ,,
,, 109. 34° 15′ S, 172° E.
,, 114. 32° 55′ S., 170° 38′ E.
,, 120. 34° 26′ S., 172° 14′ E.
,, 122. From Cape Maria Van Diemen, S. 80° W. 21 miles.
,, 129. Off Three Kings Islands.
,, 130. ,, ,,
,, 131. ,, ,,
,, 132. Spirits Bay, near North Cape.
,, 133. ,, ,,
,, 135. ,, ,,
,, 136. ,, ,,
,, 139. 34° 30′ S., 171° 53′ E.
,, 148. Bay of Islands, 35° 15′ S., 174° 10′ E.
,, 161. Melbourne harbour.

III. Sub-Antarctic Zone.

Station 232. 55° 51′ S., 165° 49′ E.
,, 251. 54° 2′ S., 177° 0′ W.

VII.—DESCRIPTIONS OF LARVAE.

PENAEIDEA.

The larval development of the Penaeidea is well known to be of a very primitive character, the larva leaving the egg either as a Nauplius (Penaeidae and Luciferinae) or in the form of a Protozoea (Sergestinae). The general course of development, so far as concerns the appearance and the character of the appendages, is remarkably uniform and would alone prove the very close relationship of the Sergestidae to the Penaeidae.

The close similarity of the larval series with that of the Euphausiacea has rightly been regarded as important evidence of the relationship of the latter to the Decapoda and their separation from the Mysidacea, but the similarity does not extend to details. In the Euphausiacea, development is quite continuous without any marked metamorphosis, and may for that reason be regarded as more primitive. On the other

hand the appendages themselves, particularly the antennae and maxillae, differ greatly from those of the Penaeidea which seem to have retained a more primitive structure, while the Euphausiacea also are characterized by extreme compression of the thoracic somites and reduction of the pereiopods. The Euphausid telson, which is, so far as is known, of very uniform structure throughout the order, has invariably a square, truncated apex with a median unpaired spine.* A precisely similar telson is found occasionally in the Penaeidea (see p. 68), but it is exceptional, and the usual type is quite different. A median spine is, however, characteristic of some Reptantia, and may be an inheritance from an ancestor related to the Euphausiacea. There is one point in which the genus *Gennadas* strikingly resembles *Euphausia* in its development, and that is in the precocious appearance of the first pair of pleopods. But the great compression of the thoracic region and the reduction of the posterior pairs of pereiopods in the Euphausiacea are strong reasons for regarding them as occupying a less primitive position than that commonly credited to them They are true Decapods, and they are primitive Decapods, but they cannot be regarded as representing the ancestral form of any higher group.

The Penaeidea differ from the Euphausiacea fundamentally in having a pronounced metamorphosis. This is especially marked in the Sergestidae, where two distinct breaks in the continuity of development, namely those between the Elaphocaris and Acanthosoma stages and between the latter and the Mastigopus, involve great changes in body form. In the Penaeidae the corresponding stages of transformation are at the moults from the Protozoea to the Mysis stage and from the Mysis to the post-larval condition. The first change in the Sergestidae is a change of body form alone, while the second involves also the assumption of the adult form of the appendages; but in the Penaeidae there is also a double transformation of the appendages. This double break in the larval series is a feature peculiar to Penaeid metamorphosis, since in Caridea, and also in Reptantia where a Mysis stage can be recognized, that stage is entirely similar in general form and in the character of the appendages to the stages which precede it, but the transformation from Mysis to post-larval condition is, as a rule, very marked.

I. Penaeidae.

The fact that the majority of the Penaeidae are deep-sea forms, and that the eggs are always set free before hatching, makes the difficulty of connecting the larvae with the adults very great. Thanks to the splendid work of F. Müller and Claus we know with sufficient detail the general course of development from the Nauplius to the Mysis stage, but we do not know with what genera they were dealing, or whether the larval series which they succeeded in tracing is typical for the whole of the family. Later authors have added remarkably little to our knowledge. Brooks (1882) was able to trace a series of larvae up to a stage recognizable as belonging to

* Claus's figures (1876, Taf. I) do not show this median spine, but it is present in all the larvae figured by Sars (1885) and in all those found in the "Terra Nova" collections.

Penaeus, but his description is not illustrated, and is too brief to be of much help to others. Kishinouye (1900) and Lo Bianco and Monticelli alone have actually observed the hatching of the Nauplius, while the latter authors have had the singular good fortune to follow the complete metamorphosis in two species—*Sicyonia sculpta* and *Solenocera siphonocera*—and in part that of *Parapenaeus longirostris* and of a species of *Gennadas*. It is most unfortunate that, with the exception of *Solenocera* and *Aristaeomorpha*, they have published no figures of any of the stages observed, and their written description is often exceedingly difficult to understand or to make use of.

Spence Bate in his "Challenger" report (1888) deals at some length with the larval stages of Penaeids, several of which are figured, but it is not possible to connect these larvae with any definite genera. His figure Pl. XLVI, fig. 1 evidently represents the Mysis stage of a species of *Gennadas*, but those shown on Pl. XLVII, figs. 1, 2, though of the same type and probably belonging to some genus of the Aristaeinae, differ from *Gennadas* in not having the large globular first pleopod which seems to be characteristic of that genus. Pl. XLVII, fig. 3 probably belongs to the Penaeinae and is referred to below (p. 68).

The earlier larvae, of which Suhm's figures are reproduced in the "Challenger" report, represent a larval series distinct from any elsewhere described. They differ from other Penaeid larvae in the early appearance of the rostrum, which attains to a very great length, and in the fact that three pairs of pereiopods appear before any trace of the last two pairs is seen. In other forms the whole (Penaeinae) or the first four (Aristaeinae) appear together. Another very unusual feature is the transformation of the jointed exopodite of the second antenna into a scale, setiferous on both margins, in the Zoea stage. The same feature is shown in the larva figured on Pl. LVIII, fig. 2, which clearly belongs to the same series. These larvae evidently do not belong to the Aristaeinae, if the larva of *Gennadas* may be regarded as typical of that family, but the arrangement of the spines on the pleon is consistent with the supposition that they may belong to a genus of the Penaeinae.

The larva shown in fig. 46, p. 240 has some of the features of an Aristaeine, but is unique in the possession of a pair of spines on the posterior margin of the carapace and of long, slender eye stalks. It is impossible to conjecture to what group it may belong.

Stephensen (1923) has described some Penaeid larvae taken by the Danish Oceanographical Expedition, and some of these will be referred to below.

As the result of the work hitherto published the only Penaeid larvae which are recognizable with certainty are those of *Gennadas* and *Solenocera*, the former through Claus's figure (1876, Taf. III, fig. 2) which Lo Bianco and Monticelli refer to as representing that genus.

In these circumstances it is not to be expected that the Penaeid larvae of the "Terra Nova" collections should be referable to definite species or even genera by

comparison with published descriptions. On the other hand, although the naming of the larvae can only be purely tentative and based on most slender grounds, it seems to me advisable to describe those that I have had for examination, since, even if the determinations are proved entirely false, there is some value in showing the variety of larval form which exists within the family. The differences between genera and sub-families, at least in later stages, are very great, and there is reason to believe that it may prove to be possible to recognize the larvae of individual genera even in the early Protozoea stages. I give below some account and figures of two series of larvae belonging, as I believe, to the genera *Penaeus* (or a sub-genus thereof) and to *Gennadas*, which are entirely different the one from the other at all stages, while Lo Bianco and Monticelli found that the Protozoea of *Sicyonia* has also recognizable characters.

I have drawn up a statement of the characters which I believe to separate the larvae of the Penaeinae and the Aristaeinae in the Mysis stage, but I recognize that the statement is not too securely founded.

There are many genera of which we do not know the larvae, and, in particular, neither those of *Cerataspis* nor of *Sicyonia* representing the other two sub-families of the Penaeidae are known. That of *Sicyonia*, it is true, has been seen and, in part, described by Lo Bianco and Monticelli, but I have not been able to form any idea of its appearance from the published description.

PENAEIDAE. CHARACTERS OF THE MYSIS STAGE.

1. ARISTAEINAE.

   Rostrum very long, with large basal spine.
   Supra-ocular spines present.
   Pleon somites with large dorsal spines, that springing from the second somite usually exceedingly large.
   Pereiopod 5 developing later than 4.
   First pleopod developed early and globular in form.
   Telson deeply cleft, the two branches narrow and parallel.

2. PENAEINAE.

   Rostrum long, with or without dorsal spine.
   Supra-ocular spines very long and slender.
   Hepatic spine present.
   Pleon somites with, or in later stages without, dorsal spines, but these spines sub-equal.
   Pereiopod 5 appearing at the same time as 4.
   Pleopoda all appearing together and of same form.
   Telson variable, sometimes truncate; sometimes the posterior margin lunate; never with parallel rami.

3. SICYONINAE.

   Unknown.

ARISTEINAE.

Gennadas (Syn. *Amalopenaeus*) (figs. 1–4).

Stage I. The earliest larva found is a Protozoea 0·98 mm. long (fig. 1). This type of Protozoea occurs in several of the collections from widely separated localities

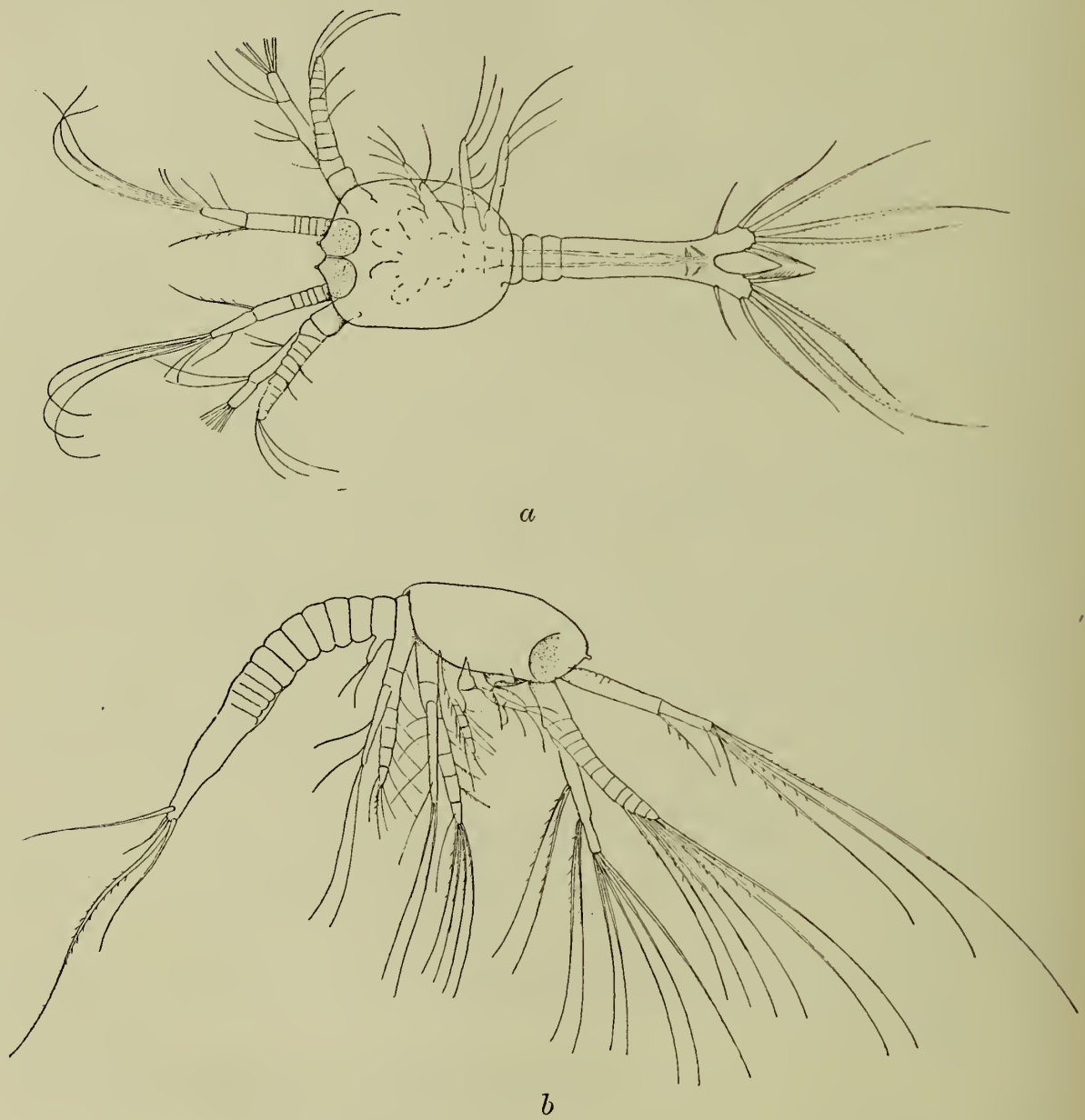

FIG. 1.—*Gennadas.* Protozoea, stage I. *a.* dorsal view (station 65). *b.* side view (station 114).

(stations 17, 66, 67, 114, 120) and it is possible that it is a type common to several Penaeid genera.

The eyes are not yet distinct, and the small frontal organs spring from the ocular region.

The carapace covers only the somite of the first maxillipede, leaving the rest of the thorax bare. All the thoracic somites are distinct, but there is no trace of pereiopods. The third maxillipede is a uniramous rudiment with two setae.

The abdomen is not yet fully segmented. The first somite is distinct, but the remaining somites, though distinguishable beneath the cuticle, are not separated until the next moult.

The telson is forked, and bears six setae on each branch.

First antenna (fig. 2, *a*). A simple uniramous appendage, consisting of three segments. The basal segment is subdivided into five sub-joints, while the third, which corresponds to the outer ramus, bears three very long ciliated setae and three short sensory setae or aesthetes. In later Protozoeas the secondary segmentation of the first joint is lost, and the appendage then consists of three joints only. In *Sicyonia* (Claus, 1876, Taf. II, fig. 3) there are four, but I do not find more than three in any of my specimens. Since the subdivision of the basal segment in the first stage is evidently nothing more than a wrinkling such as is seen in the second antenna of the Conchostraca, the peduncle primarily consists of two joints only.

Second antenna (fig. 2, *b*). The stem is two-jointed, and no evidence has been seen of the presence of three joints in any specimen examined. The second joint may be indistinctly separated, or not distinct at all from the inner branch, which is then a simple extension of the protopodite. The inner branch is two-jointed, the first joint very long and bearing a pair of long setae on a conspicuous notch about mid-way along its inner side. The short distal joint bears four long natatory setae. The exopodite is very distinctly articulated to the protopodite and is divided into eleven short joints. The fourth and sixth each bear a seta on the outer side, and natatory setae spring from the fourth and each subsequent joint.

The mandible has no trace of a palp, and the edge is armed with short spines. There is a distinction between "pars secans" and "pars molaris," but no cleft between the two.

First maxilla (fig. 2, *c*). The basal part consists of two joints each with a spine-bearing endite or lacinia. The second joint bears a small lobe with four long ciliated setae which corresponds to the exopodite and is found in precisely similar form in the Euphausiacea. One or more setae are occasionally found in this position in the maxilla of other Decapod larvae* (e. g. *Processa*, some Brachyura) and probably represent the last trace of an exopodite. In the adult *Upogebia* there is a bundle of long setae which may perhaps represent the same structure. The large exite, which develops later on the coxopodite in the Euphausiacea and corresponds to the epipodite, is not developed in the Penaeidea, but is conspicuous in *Stenopus*, some Thalassinidea, and Anomura.

The endopodite in the Penaeidea is remarkably large, consisting of three well-defined joints each bearing a pair of setae on the inner face. The terminal joint

* See below, Hoplophoridae, p. 107.

bears three long setae. The endopodite is usually greatly reduced in the Caridea, but is often well developed in the Reptantia. When well developed, e. g. in *Callianassa*, it consists, as in the Penaeidea, of three joints each with a pair of inner setae.

Fig. 2.—Appendages of larvae of *Gennadas*. *a–e*. Protozoea. *f, g*. First Mysis stage. *h–q*. Last Mysis stage. *a*. First antenna. *b*. Second antenna. *c*. First maxilla. *d*. Second maxilla. *e*. First maxillipede. *f*. Mandible. *g*. First maxilla. *h*. First maxilla. *i*. Second maxilla. *k*. First maxillipede. *l*. Second maxillipede. *m*. Third maxillipede. *n*. Leg 1. *o*. Leg 2. *p*. Leg 3. *q*. First pleopod.

Second maxilla (fig. 2, *d*). The stem of this appendage may well be regarded as consisting of three joints. There are four well-marked endites corresponding to the coxopodite and basipodite, but there is also a proximal part which has no

endite and may represent the pre-coxa. This part is better marked in the Sergestidae, where Hansen has seen a suture between it and the coxa. The exopodite is small and bears five ciliated setae. In the Sergestidae four of these setae are lost in the Acanthosoma stage and one or more may be absent in the Protozoea of Penaeidae. The endopodite, which directly continues the line of the stem, consists of four joints.

The maxillipedes (fig. 2, *e*). The two pairs of maxillipedes are very much alike, and consist of a two-jointed stem continued into a five-jointed endopodite and an exopodite which is shorter than the endopodite. The first joint of the endopodite may be partly fused with the basipodite. The exopodite differs from that of the

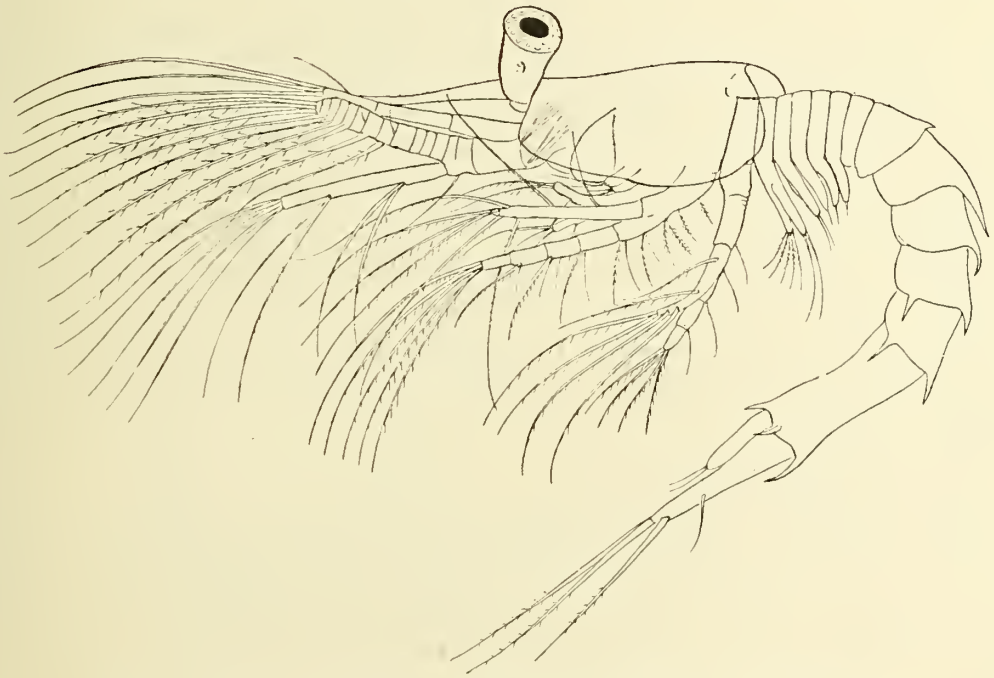

Fig. 3.—Larva of *Gennadas*. Stage IV. Station 114. Side view.

higher Decapods and resembles more the exopodite of the second maxilla in having setae disposed along its outer edge instead of concentrated at the end.

Stage II. The next protozoeal stage measures 1·4 mm., but differs little in general form from the first. The eyes are stalked, and the carapace, which now covers the somite of the second maxillipede, is prolonged into a distinct rostrum.

The telson bears seven setae on each branch.

The appendages are unchanged. There are traces of pereiopod buds on somites 1 to 3.

Stage IV (fig. 3). This larva, which measures 3 mm., probably belongs to the fourth and not to the third stage (see below).

The rostrum is longer than the first antenna and the carapace covers the somite of the third maxillipede, though the tergites of this and the preceding somite are still free. Rudiments of the first four pairs of pereiopods are present.

The abdominal somites have developed median dorsal spines, that of the first somite being very small. The spines of somites 3 to 6 are about equal, while that of the second is the longest. Somites 4, 5, and 6 have each a pair of lateral spines, the sixth having also a pair in a ventro-lateral position. The telson is unchanged.

The labrum bears a rather large spine, as it does in stage II.

The anterior appendages are essentially the same as before. The third maxillipede is larger, biramous, and bears setae on each branch.

There is no trace of pleopods except for a small knob on the first somite, but the uropods have appeared, though in a functionless condition.

The three stages above described were taken in a single collection (station 114) in New Zealand waters, and in all probability belong to a single species; but the series is not altogether complete, since I find in other collections larvae intermediate between stages II and IV. As they seem to belong to different species I have not included them in the series, but they give rise eventually to a Mysis stage of precisely the same form and may therefore be regarded as belonging to the same genus. A description will show the differences between them and the series just dealt with.

Stage III (stations 66, 67). While the general habitus of the larva, which measures 2·1 mm., remains the same as in stage II, it differs in the greater length of the rostrum and in the presence on the first four somites of the pereion of distinct buds representing the pereiopods. The abdomen is segmented, but shows no trace of appendages.

The telson is unchanged.

A larva in stage IV from the same station and therefore probably of the same species, differs from the specimen first described in having the rostrum considerably longer and in the presence of a pair of large supra-orbital spines. The dorsal spines of the abdomen are also longer, and the third somite has a pair of small lateral spines.

At station 120 a number of larvae were taken in which three stages may be distinguished corresponding to stages III and IV as described above and another somewhat more advanced. Brooks found that there were only three stages in *Penaeus* between the first Protozoea and the Mysis stage, but that the stages which he was able to define did not agree exactly with those described by Claus (1876, Taf. II). Claus's larvae are referred by Lo Bianco and Monticelli to *Sicyonia sculpta*, and it is clear that even in these early stages of development there are generic and specific differences not only in structure but also in the order of the appearance of the appendages.

Stage V. First Mysis stage. Station 114. Length, 3·77 mm., including the rostrum, which is 0·92 mm. long.

The rostrum has a large basal spine, but is otherwise smooth. There is a pair of large supra-ocular spines, but no hepatic spines. There is also a pair of large sub-ocular spines. The spines on the abdominal somites are as before, but there are now

also small median ventral spines on somites 4 and 5. The dorsal spine on the second somite is very long. On somites 1 and 2 there is a pair of lateral projections which overlap the carapace when the abdomen is flexed, and are not easy to see in side view.

The pereiopods are all present and biramous, but the fifth is not fully developed. They are inserted in a curving series so that, in side view, the posterior legs are more or less overlapped by the anterior pairs. The first three pairs are not chelate.

The first pleopod is present in the form of a round knob, but the others are not visible. The uropods are fully developed, but the exopodite has no outer spine.

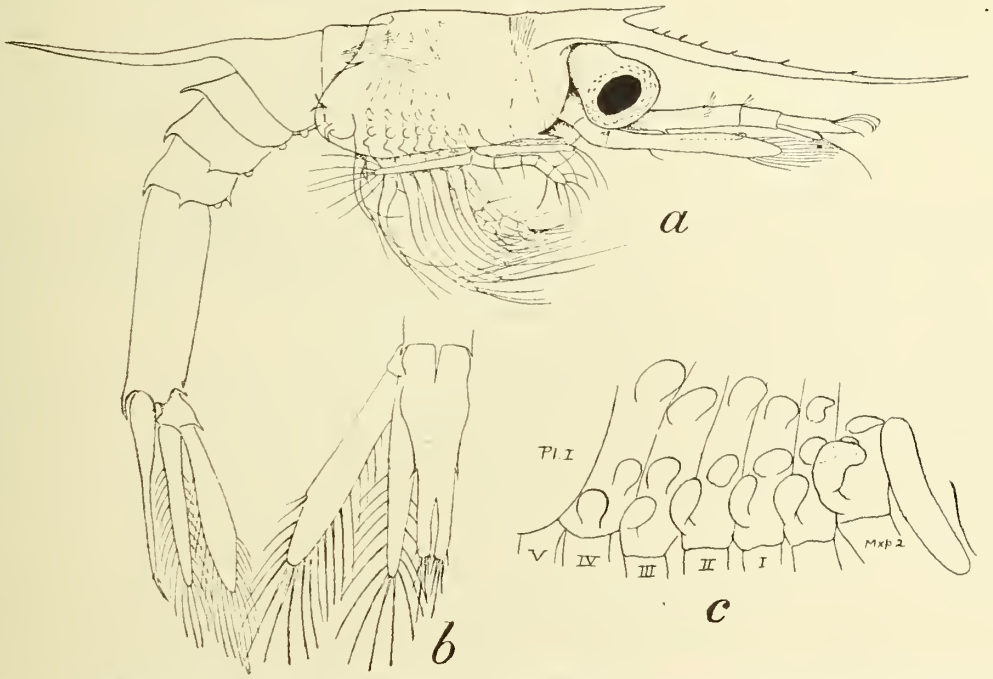

Fig. 4.—Second Mysis of *Gennadas*. Station 133. *b*. Telson. *c*. Gills of specimen from station 114.

The telson is long and deeply cleft, having the appearance of the two branches of the protozoeal telson squeezed together and lying parallel and approximated to each other. There is a pair of small lateral spines anterior to the bifurcation, and the two branches each bear six terminal spines. The spine formula is therefore still 7 + 7.

There is a profound change in the appearance of the antennae and mouth-parts, which now closely resemble in form those found in the larvae of Caridea. They will be described below in a later stage, as the structure remains much the same until the transformation to the post-larval condition. This first Mysis stage seems to correspond to Brooks's stage IV.

Stage VI (fig. 4*). Length, 3·7 mm. without rostrum (which is broken).

The part of the rostrum remaining bears five small teeth beyond the large basal

* A specimen of the same species from station 133 is figured, being better preserved than those from station 114.

spine. The second abdominal somite bears a huge dorsal spine, while the following somites have small dorsal spines, and the fifth and sixth a pair of small lateral spines. There is a median ventral spine on the fifth somite.

All the pereiopods are present and biramous, but the first three are not chelate and the fifth is still small. Gills are developed on all the somites except that of the fifth leg. There are six pleurobranchs on the somites of the second and third maxillipedes and legs 1 to 4. Each of these has also an arthrobranch and an epipodite, the epipodite of the second maxillipede rather large. The first maxillipede bears an enormous plate-like epipodite.

The pleopods are present as small buds, while uropods and telson are practically unchanged.

Stage VII (station 114). Length : rostrum, 2·3 mm. ; body, 5·55 mm.

This is no doubt the last Mysis stage, and differs from the preceding stage only in detail.

At the moult to the first Mysis (stage V) the appendages change their primitive form and take on that characteristic, under various modifications, of the Zoea of higher Decapods. It will be sufficient to describe their form in the last Mysis stage when they are fully developed. (See fig. 2, *h–q*).

First antenna. The stem is three-jointed, but the long proximal joint is not clearly separated from the second joint, the line of division being marked by a transverse row of sensory setae. This joint is dilated at its base, with a pronounced outer knob representing the stylocerite. In the notch between the stylocerite and the stem there are seated five sensory setae, but there is no trace of an otocyst or of any otic setae on the dorsal surface. There is a large spine on the ventral surface of this joint in the first Mysis, present also, but smaller, in stage VII. The terminal joint has on its inner face a group of small sensory setae which represent the "antennular lobe" (Gurney, 1923, p. 250), but this lobe is scarcely recognizable. In the last Mysis the two terminal branches are nearly as long as the peduncle, the outer branch bearing sensory rods on the first five joints. Both branches consist of one joint only in stage V.

Second antenna. The endopodite is, in stage V, a rod shorter than the scale and without setae, but in stage VII it greatly exceeds the scale in length. It is not distinctly segmented, but two joints are distinct at the base. The scale in stage V has no terminal spine and has one seta on its outer edge, but in stage VII it is a long, narrow lamella with a terminal spine and no outer setae.

The mandible in the last stage has a simple cutting edge with no spinules, and usually has no palp. The presence or absence of a palp seems to be a specific character, since in some specimens a small but distinctly two-jointed palp is present.

First maxilla. The exopodite is entirely lost. The palp may remain large in the first Mysis (fig. 2, *g*), but is reduced to a single joint in later stages.

Second maxilla. The change in the second maxilla is most striking, and the

pediform limb of the Protozoea gives place suddenly to the foliaceous type of appendage. The four inner lobes are well developed, the proximal larger than the second lobe. The endopodite is short and broad, without trace of joints. The setae of its inner edge are borne on small projections which correspond to, but are less developed than, the lobes which are found on the endopodite of some Caridea and Thalassinidea. The exopodite is a huge plate fringed all round with short setae.

First maxillipede. The stem has two large inner laciniae bearing many setae. The endopodite is five-jointed, and the exopodite bears setae along its whole outer margin. There is a large epipodite and a minute knob which may represent the rudiment of the arthrobranch.

Second maxillipede. The endopodite is large and five-jointed, but the exopodite is small and bears eight setae at the end. The epipodite shows a trace of division into mastigobranch and podobranch.

The third maxillipede differs only in the greater length of the endopodite.

Pereiopods. The first three pairs are chelate in the last stage, the endopodite of the first pair considerably longer than the two following pairs. Each of the pereiopods has an exopodite bearing eight terminal setae.

Pleopods. The first pair appears very early, and has a peculiar structure which may be distinctive of the Aristeinae. They are at first simple globular structures with a small inner spiniform process which does not correspond with one of the rami of the appendage. Later the outer ramus grows out from the globular base as a long rod, at the base of which, in stage VII (fig. 2, *q*), can be seen a minute rudiment of the endopodite. The four posterior pairs are simple biramous rudiments without setae.

The telson is long and slender and ends in a pair of pointed processes, each of which has a pair of short spines near its base. Apparently four of the seven spines of the previous larva are lost.

The gills are still rudimentary in the last Mysis, but are distinctly visible and disposed as follows:

	Mxp. 1	Mxp. 2	Mxp. 3	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5
Epipodites	Ep.	Ep + r.	Ep.	Ep.	Ep.	Ep.	Ep.	—
Arthrobranchs	—	?	2	1	1	1	1	—
Pleurobranchs	—	?	1	1	1	1	1	1

Penaeid larvae in the Mysis stage and agreeing almost exactly with those just described are common in the "Terra Nova" collections from a number of stations. The agreement is so close that there can be no doubt that they belong to the same genus, but it is possible to find differences among them which prove that they do not belong to the same species. For example, the rostrum may be smooth, armed with small denticles, or strongly spined as in the form figured. All the larvae from the

Atlantic have smooth or nearly smooth rostra, while those taken in the Pacific have strong spines. I have made no special effort to find minor specific differences such as may probably exist in the form of the telson, relative length of spines, &c.

The identification of this type of larva with the genus *Gennadas* rests upon the authority of Lo Bianco and Monticelli, who (1900) refer to Claus's figure 6, Taf. III (1876) as representing the Mysis stage of *G. elegans*. On the other hand, it is possible to utilize the evidence of the gill formula of the late Mysis to obtain at least an approximate determination, even though the formula is not complete at that stage.

The presence of an epipodite on the fourth leg and of a pleurobranch on legs 4 and 5 excludes the whole of the Penaeinae from consideration.

Of the Aristaeinae the absence of hepatic spines excludes *Hepomadus* and *Aristaeomorpha*, while *Aristeus* and *Hemipenaeus* have no epipodite on the fourth leg. There remain *Plesiopenaeus*, *Aristaeopsis*, *Benthesicymus*, and *Gennadas*, none of which have an hepatic spine. Beyond this it is impossible to go on the structure of the larva, but it is permissible to suppose that, as the pleurobranchs are so well developed, they would probably give rise to gills of normal size ; so that *Benthesicymus* or *Gennadas* is indicated.

Stephensen (1923, p. 20) has discussed the identity of larvae of this type, and has given reasons for believing that more than one species are included in it. It seems probable that this "*Euphema armata*" type, without hepatic spine, is the larva of the genus *Gennadas*, and that the same general form, of which the chief characteristic is the enormous spine on the second somite of the abdomen, may be confined to the Aristeinae.

Aristeinae.

2. *Hepomadus?* (fig. 5).

At station 232 a single larva in the Mysis stage was taken in company with others attributed to *Gennadas*, but it differs from them in several important respects. This larva in its general habitus is clearly of the same type as that of *Gennadas*, and no doubt belongs to some genus of Aristeinae.

This larva, which is in the first Mysis stage, is 5·5 mm. long, the rostrum alone being 0·9 mm. from the basal tooth to the end. It differs from *Gennadas* in having a pair of hepatic spines, but lacks the spine at the anterior angle of the carapace (pterygostomial). There is no spine on the second somite of the abdomen, but the following somites each bear a large spine, that of the sixth being the longest. There are short lateral spines on somites 4 to 6.

The telson is long, narrow, and deeply cleft, but the two limbs are not narrowed as in *Gennadas*. Each branch bears a lateral and seven terminal spines.

The fifth pair of legs is not fully developed, but the first pair of pleopods is

represented by large globular structures with a minute inner branch. The remaining pleopods are not visible. The uropods are large, the exopodite expanded distally but with no outer spine.

The general form of the body and rostrum together with the retarded development of the fifth pereiopod and the precocious appearance of the first pleopod are characters which I believe distinguish the larvae of the Aristeinae from those of

Fig. 5.—Mysis of *Hepomadus* (?) with enlarged view of end of telson. Station 232.

the Penaeinae; but the presence of an hepatic spine, and the absence of a large spine on the second abdominal somite sharply distinguish this form from the larva of *Gennadas*. Among the Aristeinae the hepatic spine is present in some *Benthesicymus*, in *Aristaeomorpha*, and in *Hepomadus*. As the larvae of none of these genera are known,* and the gills are not developed in this young specimen, it is impossible to do more than to assign it to one of these genera.

* Lo Bianco and Monticelli (1902) have described the larva of *Aristaeomorpha foliacea* (*Aristeus antennatus*), but I believe that they were mistaken in their identification (see below, p. 68).

ARISTEINAE.

Larva 3. (*Benthesicymus?*) (fig. 6).

Station 251. Length, 7·75 mm., including rostrum, 1·85 mm.

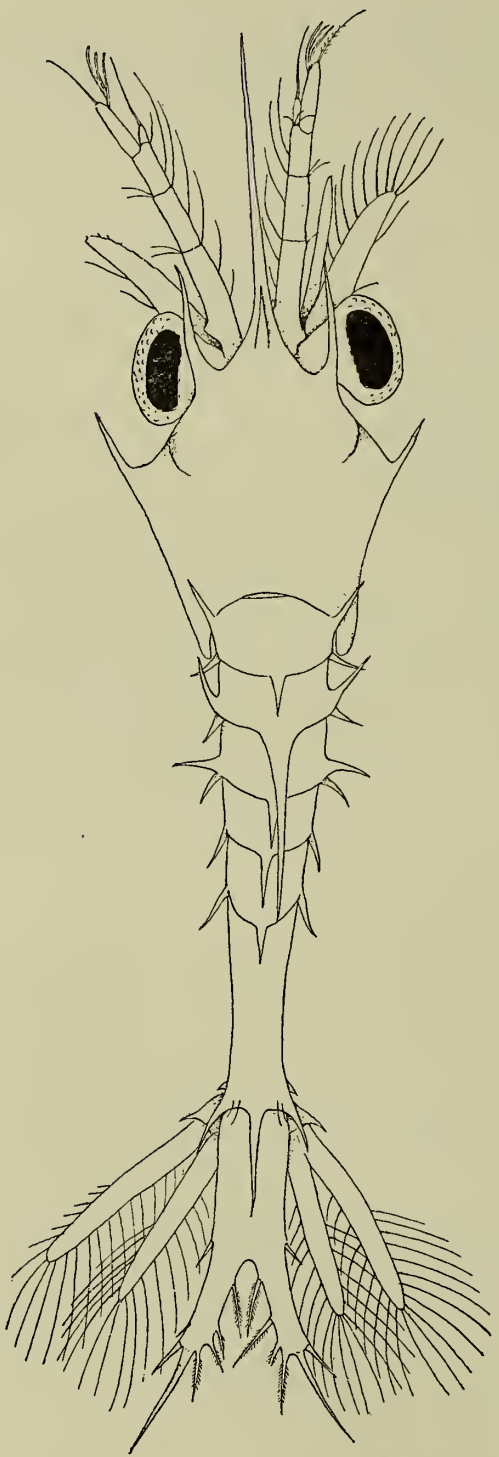

FIG. 6.—Mysis stage of *Benthesicymus (?)*. Station 251.

This larva is of the same general form as that attributed to *Gennadas*, and differs only in detail, particularly with regard to the armature of the abdominal somites.

There are long supra- and sub-orbital spines, and the rostrum has only the one basal spine usual in this Euphema type. There is no hepatic spine.

The first three abdominal somites have the epimera laterally expanded and with two points.

The second somite has an enormous dorsal spine reaching beyond the fifth somite, while the dorsal spines of somites 3 to 5 are small. Somites 4, 5, and 6 have each a single pair of posterior spines corresponding to the ventro-lateral pair of the preceding somites. The dorsal spine of the sixth somite is long and there are a few short hairs at its base.

The telson is long and slender, deeply bifurcate, but the arms are slightly divergent and not parallel as in the typical form. It bears 8 + 8 spines in all, the fourth being long and having the appearance of being a prolongation of the narrowed end of the branch of the telson itself.

In the oldest stage examined there are epipodites on each of the maxillipedes and on legs 1 to 4.

The third maxillipede and first four legs have each an arthrobranch, and pleurobranchs also are present on the second maxillipede and the fifth leg. The first three legs are chelate.

The exopodites of the legs are very long and bear an unusually large number of setae, e. g., twelve on leg 1.

The mandible bears a rather long, narrow palp of two joints.

There is a median ventral spine on the fourth and fifth somites of the abdomen.

This larva differs from that of *Gennadas* in the presence of additional spines on the abdomen, and in the form of the telson, and probably represents a distinct genus.

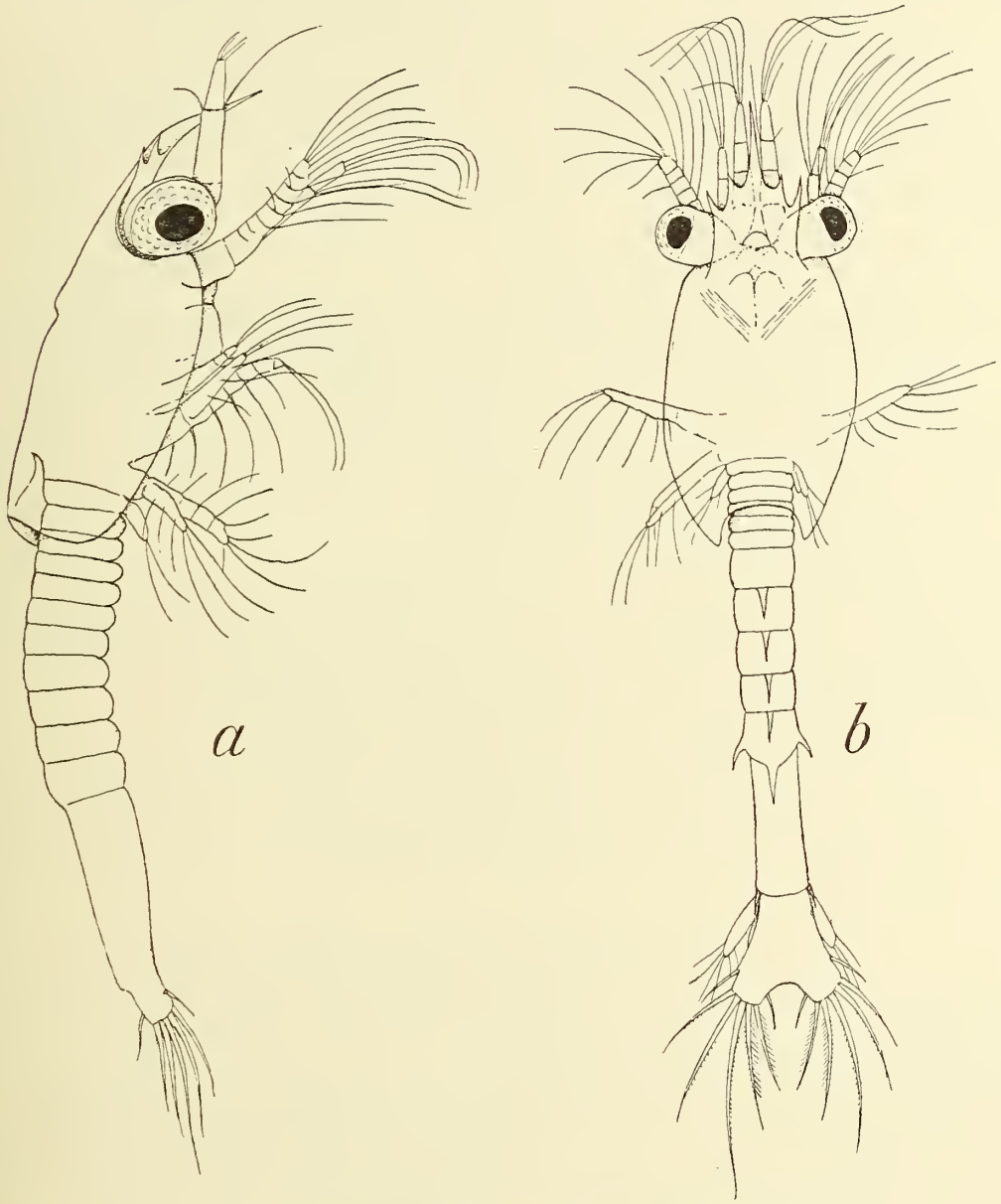

Fig. 7. *Parapenaeus* (?). Station 40. Stages I (*a*) and II (*b*).

I assume from the general form that it belongs to some genus allied to *Gennadas*, and therefore a member of the series Benthesicymae. It would then belong probably to *Benthesicymus*.

A similar larva has been described by Ortmann (1894, p. 77) under the name of *Euphema polyacantha*, and Stephensen (1923, p. 24) describes another form which

closely resembles both Ortmann's larva and also another described by Bate (1888, p. 241) as possibly belonging to *Aristeus*.

It seems that, as in the case of the *Euphema armata* type, we have in larvae of the type of *E. polyacantha* a generic series.

Penaeinae.

Species I. (*Parapenaeus?*) (figs. 7–9).

At stations 40 and 43 a few larvae were taken which evidently belong to the same genus and probably to the same species of Penaeid. For reasons which will be given below it is almost certain that the species belongs to the sub-family Penaeinae. The larval series is not complete, but includes three stages.

I. (= stage II). Length, 1·6 mm. (fig. 7, *a*).

The single specimen probably represents the second Protozoea of the whole series. The eyes are stalked, but overhung to some extent by the enormously broad rostral extension of the carapace. This rostrum consists of a broad plate extending beyond the eyes and then abruptly narrowed to a pointed spine which does not reach the end of the first antenna. At the point where the rostrum contracts there are two forwardly pointing teeth.

The thorax and abdomen are both segmented, but there is no trace of appendages behind the rudimentary second maxillipede. The telson is not so deeply divided as in the larvae of *Gennadas*, but bears the same number of setae, 7 + 7.

The appendages are of the usual Penaeid form described above.

II. (= stage III). Length, 2·35 mm. (fig. 7, *b* and fig. 8).

The form of the rostrum is approximately the same, except that the outer pair of spines, which are the equivalent of the supra-ocular spines, are longer. The thoracic region is shortened and more compact, the carapace now covering the greater part of it.

Each of the somites of the abdomen bears a median dorsal spine, all being about the same length, while the fifth somite bears a pair of lateral spines which are conspicuous in dorsal view. The sixth somite has a pair of long lateral spines and a ventro-lateral pair below the uropods.

The character of the appendages is unchanged and the third maxillipede is still small, but rudiments of all the pereiopods are present and the uropods are developed, though shorter than the telson. The latter is of more or less triangular form, with a shallow posterior sulcus and a formula of 7 + 7.

III. (= stage V). Length, 5·3 mm. (fig. 9).

This is probably the first Mysis stage.

The rostrum is long and slender, with two very small teeth at its base and a pair of large supra-ocular spines. There is a small hepatic spine, and the anterior ventral margin of the carapace is denticulate. The first two somites bear no spines, but segments 3 to 6 have median spines increasing in size backwards. Somites

5 and 6 have a lateral pair of spines, the sixth having also a ventro-lateral pair. The telson is long, parallel-sided, and the end square with a very small median incision. There are two pairs of short lateral spines and six terminal pairs, a formula of 8+8. The fourth spine is greatly the largest (fig. 9, *b*).

The appendages are now of the form characteristic of the Mysis stage. All the pereiopods are developed and have setose exopodites, while the first three pairs are chelate. Pleopods are present and the uropods are well developed, the exopodite with a terminal spine.

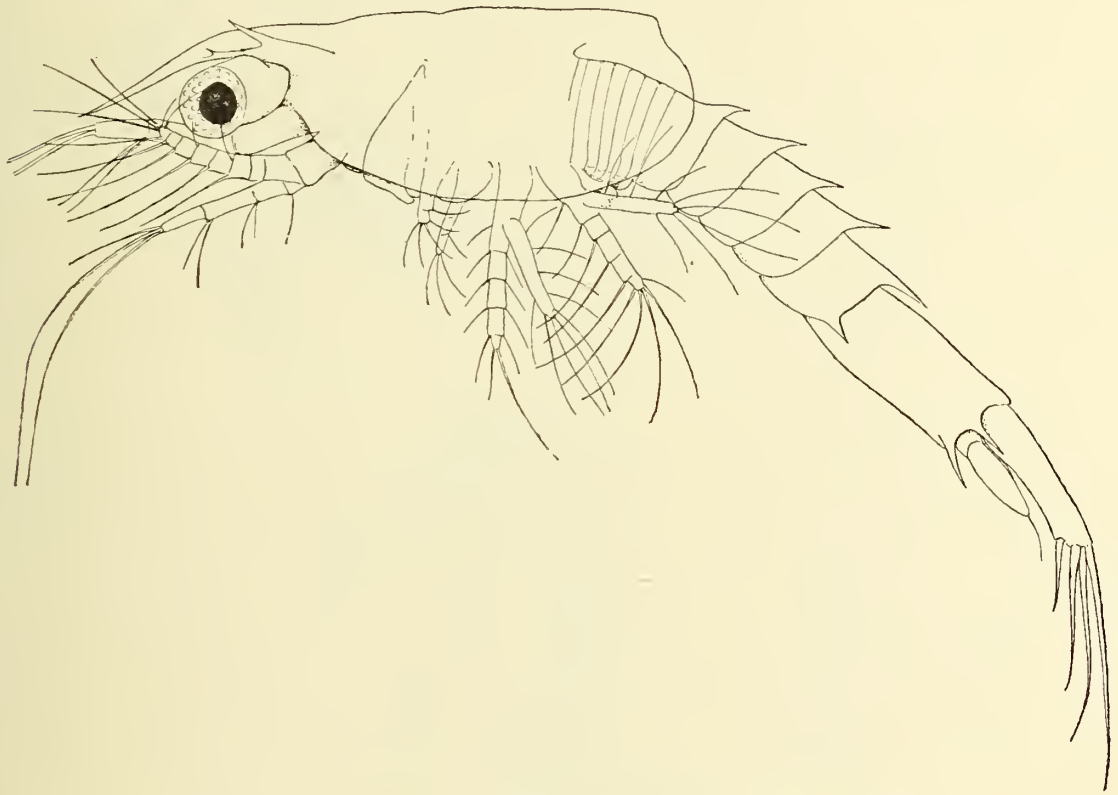

Fig. 8. *Parapenaeus* (?). Stage II, side view. Station 43.

The gills are so small and indistinct that their number is uncertain. Epipodites are visible on the maxillipedes and the first three legs, but there are none on legs 4 and 5. A series of six small gills are visible above the second and third maxillipedes and legs 1 to 4, having the position of pleurobranchs, but they are extremely small. I have not seen any arthrobranchs.

One other larva may be mentioned here as probably belonging to the same genus, but to a different species. This larva was taken at station 43 together with those just described. It is 1·7 mm. long, and differs only from stage III as described above in its smaller size, in the much greater size and length of the first antennae, in the smaller dorsal abdominal spines, and in the absence of a lateral pair on the fifth somite. The rostral region is damaged, and it is uncertain if a rostrum was present at all. The eyes are on longer stalks.

There is very little in published records to assist in assigning the systematic position of these larvae, since I know of no figure of any larva at all resembling them. If Brooks's identification of his larvae as belonging to *Penaeus brasiliensis* is correct then four characters of value for the genus may be found in his description.

1. The fifth pereiopod appears simultaneously with the preceding pairs.
2. The pleopods all appear together, the first not preceding the others as in *Gennadas*.

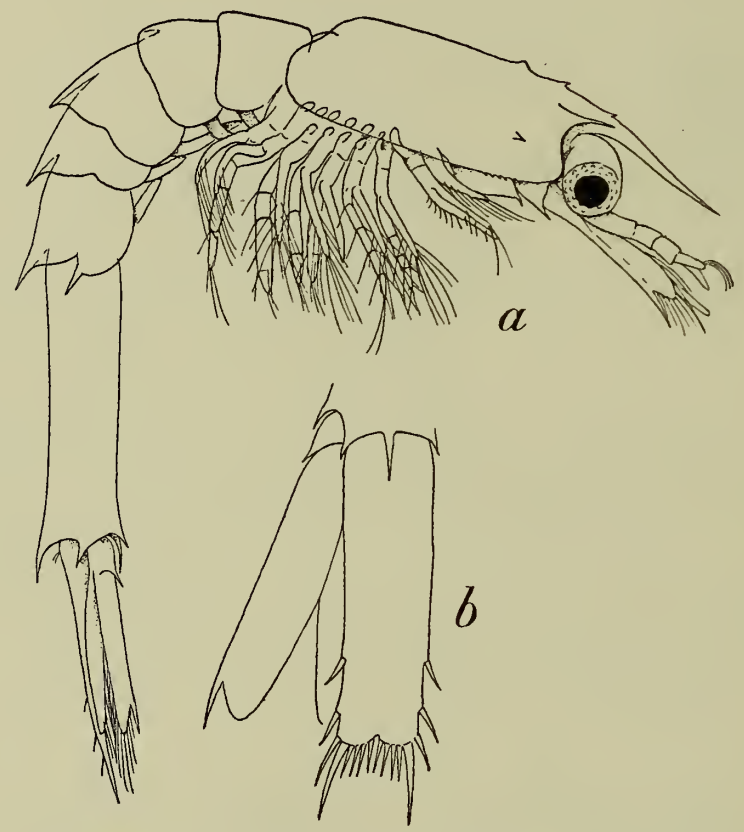

FIG. 9. *Parapenaeus* (?). Station 40. Mysis stage. *b*. Telson and Uropod.

3. The telson in the Mysis stage is square at the end.
4. There is no large spine on the second somite of the abdomen.

These characters are all found in the larvae in question. Lo Bianco and Monticelli (1901) describe some stages in the development of *Parapeneus longirostris* (*Penaeus membranaceus*), but their account is not illustrated, and I find the utmost difficulty in understanding it. They refer to Claus's Taf. III, figs. 7, 8 (1876), as representing a larva closely resembling the Mysis stage of *P. longirostris*, and this larva possesses all the characters given except that the telson is deeply incised. It is, however, of the parallel-sided type. Their description of the rostrum of the early larva, if I interpret it correctly, agrees well with the form above mentioned.

The absence of an epipodite from the fourth leg, and of a pleurobranch from

the fifth, points also to the genus *Parapeneus*, although the presence of an epipodite on the third maxillipede is rather against such an identification.

There can, I think, be no doubt that these larvae belong to a species of the sub-family Penaeinae, and I have very little doubt also that they belong to the genus *Parapeneus*.

F. Müller (1863, Taf. II, fig. 9) describes a larva which evidently belongs to a closely allied species, but he does not suggest any identification.

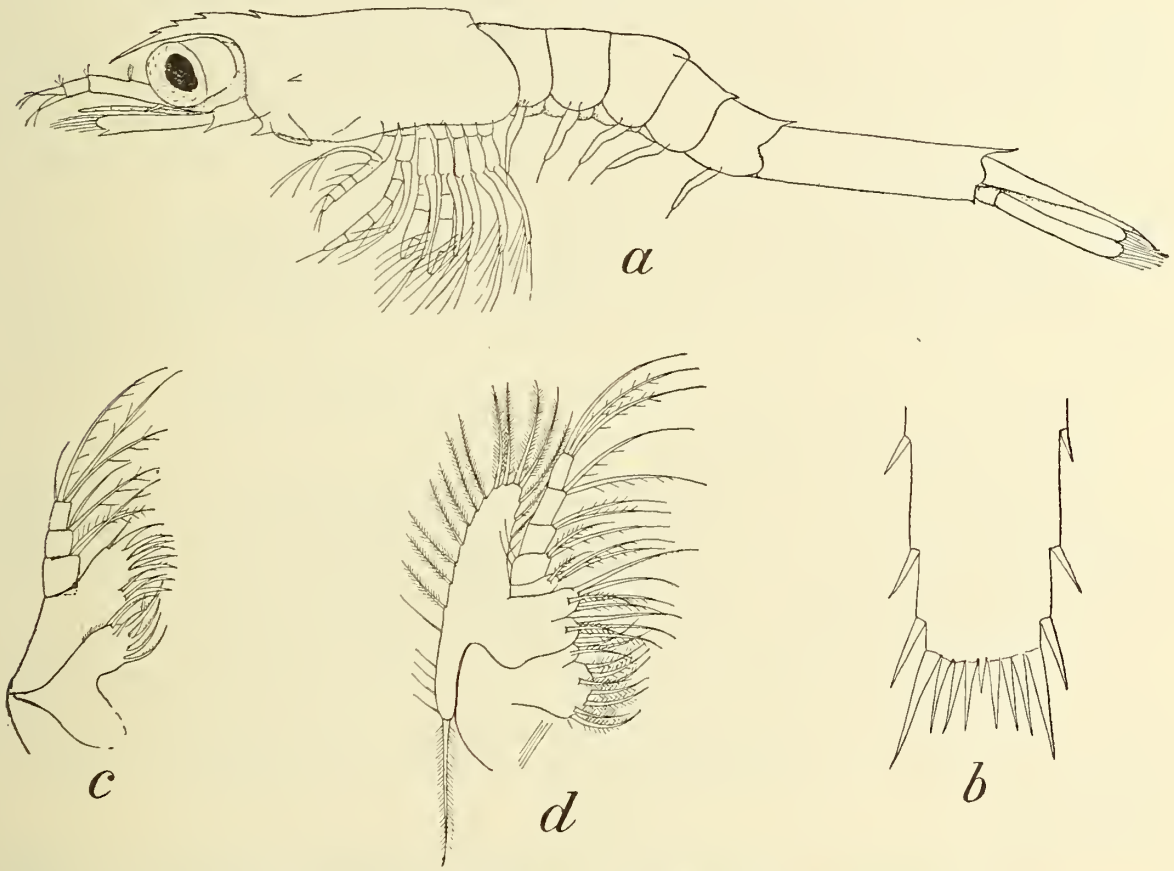

Fig. 10. *Penaeopsis* (?). Station 40. *a*. Mysis stage. *b*. Telson. *c*. First maxilla. *d*. Second maxilla.

Penaeinae.

Species II. (*Penaeopsis* or *Artemesia?*) (station 40). Length, 4·5 mm. (fig. 10).

This larva, which is in a late Mysis stage, evidently belongs to the Penaeinae, and possesses certain features of interest which make a description advisable.

The rostrum resembles that of some Hoplophoridae (*Bentheocaris*), being down-curved, sharp-pointed, and with three or four dorsal spines. In addition, one spine springs from the carapace behind the eye leaving a wide gap between it and the first rostral spine. The rostrum is about half the length of the carapace and without spines on its lower border. In one of the two specimens there are a few short hairs on the upper margin between the teeth.

There is no supra-orbital spine, but a small hepatic spine is present, and a spine on the anterior ventral angle of the carapace. The anterior third of the ventral margin is minutely denticulate.

The first three abdominal somites are altogether devoid of spines, but the succeeding somites have each a very short dorsal spine, that of the sixth somite being the longest.

The telson is long, narrow, and parallel-sided, truncated at the end. It bears towards the end three pairs of lateral spines and the distal margin is armed with nine spines of which the outermost is the largest. The possession of a median unpaired spine is a feature of special interest, since such a spine is not found in any other Natantia with the single exception of a larva recently described by Stephensen (1923) and attributed by him doubtfully to *Funchalia*. The resemblance of the telson of this larva to that of a Euphausid Calyptopis is remarkable.

The eyes are shortly stalked, nearly globular, and with black pigment.

There is nothing of special interest with regard to the appendages, which are of the usual Penaeid form. The mandible has a long palp, but it is not jointed and has no setae.

The first three pairs of legs are chelate, the third being the longest.

The pleopods are simple uniramous rods.

The gills are not fully developed at this early stage, and I have only been able to ascertain that there is an epipodite on the first two and possibly also on the third maxillipede, and a single gill in the position of a pleurobranch on the third maxillipede and the first three legs. No gills were visible above the last two pairs.

A larva from New Zealand has been figured by Bate (1888, Pl. XLVII, fig. 3) which so closely resembles the specimen just described in form of rostrum that there can be little doubt that it belongs to the same genus, but not to the same species, as it has a large spine on the third somite of the abdomen. Bate gives no description of the telson.

In the form of the rostrum there is some approach to that of *Artemesia*, but the uncertainty with regard to the gill formula makes any real comparison with the adult valueless. The very rudimentary condition of the gills in the Mysis stages seems to be rather characteristic of the Penaeinae as compared with the Aristaeinae (*Gennadas*).

Penaeinae.

Species III. (*Funchalia?*) (fig. 11).

At station 92 a single specimen of a late Penaeid larva was taken which agrees so closely with a larva described by Stephensen (1923, p. 15) that I cannot doubt that it belongs to the same genus, though not to the same species. Stephensen's larva is the same as that described by Lo Bianco (1903) as belonging to *Aristaeomorpha foliacea* (*Aristeus antennatus*), and Stephensen accepts this identification;

but my own specimen, which is in an older stage, has characters which, as I hope to show, render an identification with the genus *Funchalia* more probable. The larva was first described by Monticelli and Lo Bianco (1902) and attributed to *Aristaeomorpha* by a process of exclusion, since they were, as they supposed, familiar with the larvae of all the remaining species of Penaeids occurring in the western Mediterranean. *Funchalia woodwardi* is now known to occur in the Mediterranean, where it is apparently not uncommon (Stephensen, 1923).

The "Terra Nova" specimen measures 10·3 mm. and is of very slender form, the abdomen nearly three times as long as the thorax (excluding the rostrum). The rostrum is long, slightly down-curved, and without any dorsal spines. There is a

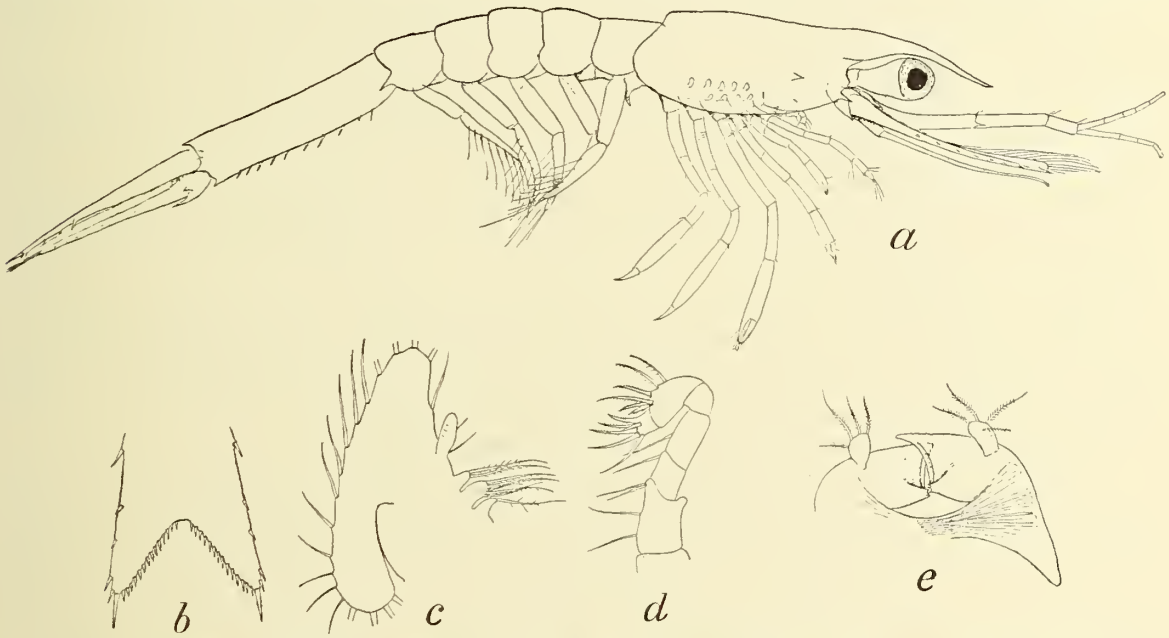

Fig. 11.—*Funchalia* (?). Adolescent. *b*. Telson. *c*. Second maxilla. *d*. Second maxillipede. *e*. Mandibles.

small supra-ocular spine, an hepatic spine, and a spine at the anterior ventral angle of the carapace.

The somites of the abdomen have no dorsal spines except the sixth, which has a slight median ridge which projects backwards as a short spine. The first four somites have each a stout ventral spine which, in the first and second somites, is fairly large and curves slightly forward. In Stephensen's species these somites bear much longer and more slender spines, and these are directed backwards.

The fifth and sixth somites each have a pair of lateral spines. The sixth somite is very long and slender, and armed along its lower edge with a series of small spines—a character which is most unusual and enhances the similarity of this larva with that of Stephensen.

The telson is of great length and size, and in general form resembles that of Stephensen's larva, widening out distally and being deeply hollowed behind (fig. 11, *b*).

But in place of a single pair of marginal spines there are three such pairs, and the large terminal spine is not so long. The differences in the telson are, however, such as would be accounted for by a difference in age, and the agreement is otherwise very close. The uropods also agree in shape so far as can be seen, but they are so damaged that their shape is difficult to be sure of. The outer branch has a row of spinules along its margin which is another striking point of resemblance to Stephensen's larva.

The peduncle of the first antenna is exceedingly long and slender, the first joint longer than the second and third combined, and having a strong spine on its outer terminal angle. The flagella are broken.

The scale of the second antenna is long, narrow, and with a row of spinules along its outer edge. The flagellum scarcely exceeds the length of the scale.

The mandibles are slightly asymmetrical, that of the right side having the cutting edge produced into a long triangular point. The palp is quite small, one-jointed, and bears four setae (fig. 11, *e*).

The second maxilla (fig. 11, *c*) is of peculiar form, the basal laciniae being reduced to three small finger-like lobes. The endopodite is rudimentary, but the scaphognathite is very large.

The exopodite of the second and third maxillipede is represented only by a minute knob, and no trace of an exopodite can be found on the fifth leg. A small vestige remains on each of the first four legs.

The pleopods are long and well developed, but uniramous.

Of the gill formula I am unable to speak with certainty. The animal is in such a bad state of preservation and the gills so small that it may well be that I have overlooked some. There is certainly no gill on the fifth leg, but there are gills in the position of pleurobranchs on the third maxillipede and the first four legs. There appears also to be a single arthrobranch on the third maxillipede and on each of the first three legs. I have not seen any epipodites.

The affinities of this adolescent specimen cannot be determined by the gill formula, but there are some characters which are very distinctive and seem to justify the conclusion that it belongs to the genus *Funchalia*.

Bouvier (1908) has given a very full account of *Funchalia woodwardi* and also of its young stage Grimaldiella, with which my specimen may be compared.

As regards the mandible it must be admitted that the agreement is not close, but the form of the palp, though one-jointed, is not unlike that of Grimaldiella with its enlarged distal joint, and there is undoubtedly an elongation of the blade which might well change to the sickle shape at the next moult. It may be worth mentioning that the right mandible *in situ* had so distinctly a falcate appearance that the possibility of *Funchalia* being the parent at once occurred to me. This impression is not so clear when the appendage is seen from behind, as it is shown in my figure.

The resemblance between the second maxilla of my specimen and that of

Grimaldiella is almost complete. In both of them this appendage is degenerated in respect of the endites, the proximal endite being lost entirely. This loss of the proximal endite is a feature unique, so far as I can find, among the Penaeidae.

As regards the loss of the exopodites of the maxillipedes Bouvier has already commented on the remarkable fact that, whereas in the adult *Funchalia* the second and third maxillipedes have long flagelliform exopodites, in the young Grimaldiella stage these exopodites are reduced to functionless rods without setae, and he supposes that the Mysis stage preceding Grimaldiella possessed, as is the case in other Penaeids, functional exopodites on these appendages.

I consider the absence of these exopodites, which is unknown in any other Penaeid, to be the strongest possible reason for identifying my specimen with *Funchalia*. If this identification is correct, it is evident that this is an additional stage between the Mysis and Grimaldiella stages in which the reduction of the exopodites is even more complete. The phenomenon is comparable to the total loss in the Mastigopus stage of the Sergestidae of the last two pairs of pereiopods and their subsequent reappearance. Such loss or degeneration of appendages in larvae and their later regeneration is one of the most unaccountable features of Decapod metamorphosis, and is perhaps less rare than has been supposed. An example of temporary degeneration is given below (p. 99) in the case of the mouth-parts of the larvae attributed to *Petalidium*, and a similar temporary degeneration of the exopodites of the second and third maxillipedes takes place in *Leander* and *Palaemonetes*.*

The same phenomenon of the temporary disappearance of parts is illustrated in the mandible and second antenna of all Decapoda. In the Penaeid Nauplius there is a biramous palp on the mandible, but this is lost in the Protozoea, and in all Decapods the mandible has no palp in early stages. It is often not acquired until post-larval life.

The case of the second antenna is rather different. The endopodite is, in the Protozoea of Penaeids, a well-developed natatory branch with long setae. In the Mysis stage it becomes reduced to a functionless rod which develops later into the flagellum. In the same way in most Decapods it bears setae in the earliest Zoea, and it is transformed at the first or second moult into a simple, unarmed rod. There is no disappearance here, but there is a distinct regression.

In *Funchalia* the exopodites of the pereiopods disappear altogether in the Grimaldiella stage, to reappear again in the adult in a rudimentary condition—an even more inexplicable example. These exopodites are, as I have said, rudimentary, though not altogether absent, in the "Terra Nova" specimen. Apparently the same temporary disappearance of the exopodites of the pereiopods occurs in some species of *Penaeus*. Brooks (1882) states that the exopodites disappear in stage VI (a post-larval stage) of *Penaeus brasiliensis*; but exopodites are present in the adult of this species.

* See also p. 171, *Upogebia*.

If I am right in supposing that the specimen here described is a stage in the development of a species of *Funchalia* it is certain that it represents an undescribed species, and is of interest in extending the range of the genus to New Zealand waters. Only two species of the genus have been described—*F. woodwardi*, Johnson, and *F. vanhöffeni*, Lenz and Strunck, both from the Atlantic. Balss has, however, recorded *F. woodwardi* from the Indian Ocean (1914), where it was taken by the "Valdivia" at station 182, 16° 8′ S. lat., 97° 14′ E. long.

I am greatly indebted to Dr. Stephensen for most kindly sending to me his two *Aristaeomorpha* larvae for examination. A study of these two specimens brings out one or two points of some interest.

The earlier larva is sufficiently described by Dr. Stephensen. At this stage there is no trace of gills, and the mouth-parts have not lost the larval characters. The mandible has no palp, and the second maxilla has four well-developed basal lobes.

The young specimen from station 384 is in the first post-larval stage and agrees with my own in all essentials, though differing in details which may be regarded as specific. The ventral spines which are so striking on the abdominal somites in the preceding stage are now greatly reduced, that of the second somite alone being large and pro-curved.

The telson differs but little from the preceding stage, and has only a single pair of lateral spines.

The scale of the second antenna has a row of five spines along its outer margin, in this respect resembling my specimen very closely.

The mandibles I have not dissected out, but they appear to have the blade rather more produced than in my specimen and to have a rudimentary palp without setae.

The first maxilla consists of a small basal and a very large distal lobe bearing about seven strong spines, while the endopodite is rudimentary.

The second maxilla resembles that of my specimen in the great reduction of the laciniae, but in this case the reduction has gone even further and only two lobes remain.

The labrum still retains a trace of the larval spine.

The exopodites of all the maxillipedes and pereiopods are reduced to minute buds.

The pleopods are large, setose, but uniramous.

I was unable to see any trace of gills, but epipodites were seen on the first and second maxillipede, and on legs 2 to 4. From the appearance of the telson I should judge that the next moult would have brought little change, and probably the "Terra Nova" specimen represents a stage slightly older than that just described.

The close similarity between these larvae in every respect leaves no doubt at all that both belong to the same genus, but it must be admitted that there seems to be a radical difference with regard to the epipodites. On the other hand the branchial system is so ill-developed and errors of observation consequently so easy to make that no great importance should be attached to this fact.

Stephensen (1923, p. 26) has described a larva taken in the Mediterranean which he refers doubtfully to *Funchalia*, mainly on the ground of the similarity of the telson to that of Grimaldiella. He gives no account of the mouth parts beyond stating (p. 21) that the mandibles show no sign of elongation. If I am right in identifying his *Aristaeomorpha* larva and the "Terra Nova" specimen with *Funchalia* some other parentage will have to be found for his *Funchalia* larva. May this perhaps be the true *Aristaeomorpha*?

Penaeinae.

Solenocera.

Monticelli and Lo Bianco have followed the development of *Solenocera siphonocera*, and the latter has fortunately published figures of the larva (1904) which make its recognition easy. The larva is of very remarkable form, strikingly unlike that of any other Penaeid, and has been described by Bate (1888) under the name of *Platysacus crenatus* and by Ortmann (1893) as *Opisthocaris mülleri*. Stephensen (1923) records the capture of numbers of larvae, mostly in the Mysis stages, in the Mediterranean, and also at stations in the Channel and outside Gibraltar. He notes that the larvae were met with at considerable depths (500 to 1,000 m.). Bate's specimen, which he regarded with good reason as belonging to some genus of Sergestidae, was taken off Sierra Leone and Ortmann's from the Florida Stream and off the Brazilian coast. Ortmann pointed out the resemblance of his larva to that described by F. Müller (1863, Taf. II, figs. 18–22)—also from the coast of Brazil—and there can be no doubt that Müller's larva also belonged to a species of *Solenocera*.

In the "Terra Nova" plankton I have found a few specimens of *Solenocera* larvae from station 43, and from three stations in the Pacific north-west of New Zealand. As these specimens differ in some respects from those previously described, and probably represent distinct species, some description may with advantage be given.

Atlantic Species. (Station 43) (figs. 12 and 13).

Stage I. Protozoea. Length, 1·7 mm.

Unfortunately the only specimen of this early stage is moulting and too distorted for its structure to be accurately made out, but it seems to me not to differ much in appearance from the next stage. There are no uropods, and the third maxillipede is present though rudimentary. The telson has seven setae on each side.

While the spines and lappets described below appear to be arranged in a similar way in this larva, it is important to note that there is a pair of large spines on either side between the rostrum and the supra-ocular pair. These spines are branched like those of Sergestids and are lost at the next moult.

Stage II. Length, 2·8 mm. (fig. 12).

The carapace is broad and rather flattened, with a stout rostrum slightly exceeding the length of the first antenna. The rostrum has a row of small spinules, and on

either side of it is a long denticulate supra-ocular spine. The margin of the carapace is drawn out into a series of five lobes or lappets on either side, each of which bears a number of short spines, while a sixth pair projects from the posterior margin. On the dorsal surface of the shell are a number of spines arranged as shown in the figure. A remarkable feature is the very great size of the "dorsal organ," which is a structure rather recalling the end of an elephant's trunk, with four small terminal lobes.

The abdominal somites bear dorsal and lateral spines of great length.

The two branches of the telson diverge so much that it has almost a T-shape, and each lobe bears eight setae.

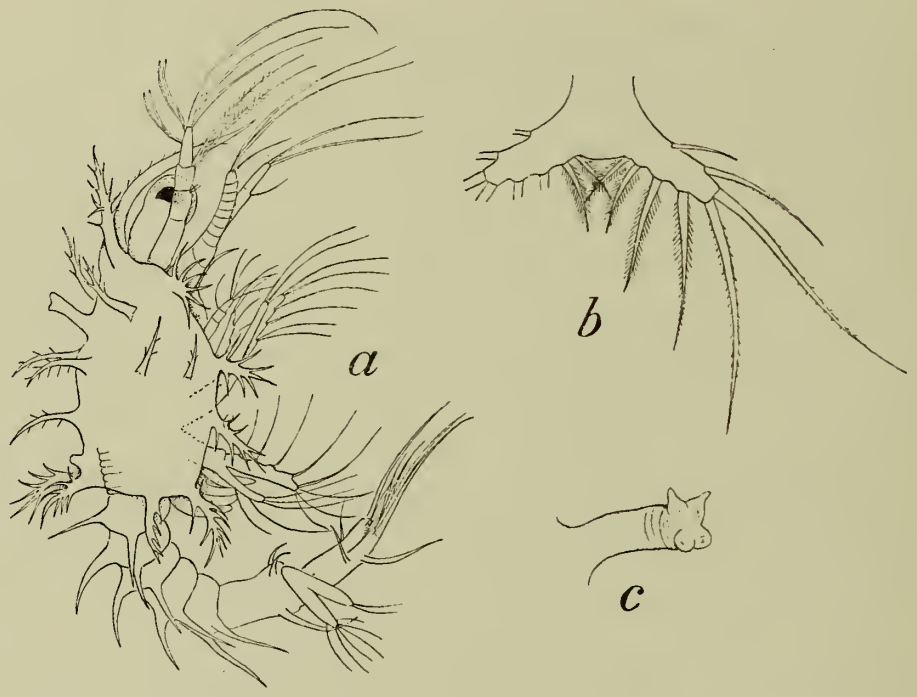

Fig. 12.—*Solenocera*. Station 43. Protozoea. *b*. Telson. *c*. Dorsal organ.

The pereiopods are present in rudimentary form, and the uropods are large and with a few terminal setae, but there are no pleopods.

The spiny carapace, and especially the abdomen, are remarkably like those of Sergestid larvae, and, if it were not for the dark pigmentation of the eyes, the larva at this stage would easily be taken for that of a Sergestid.

Stage III. Length, about 4·3 mm. (fig. 13).

This stage resembles very closely the Mysis stage figured by Lo Bianco, but differs in detail, the surface of the carapace bearing more numerous small spines, and its margin being less spiny. The lateral lappets have disappeared, but there are three pairs of small spiniferous processes on the posterior margin. The dorsal organ is still present, but more reduced.

The shape of the telson and its armature differ a good deal from that of *S. siphonocera*, and the uropods also differ in having a spine on the outer margin

of the exopodite. In this last respect it resembles Müller's larva, but the latter differs in its much longer rostrum and the arrangement of the spines on the carapace.

It is quite clear that this specimen does not belong to the same species as Müller's

Fig. 13.—*Solenocera*. Stage III. Station 43.

Fig. 14.—*Solenocera novae-zealandiae* (?). Protozoea. Station 93.

larva, neither is it the same as Ortmann's *Opisthocaris mülleri* if Ortmann's figure is correct. But if this is so we have here larvae of three species of *Solenocera* from a region where no adult species has, so far as I am aware, been recorded. On the other hand two species, *S. africana*, Stebb. and *S. comatus*, Stebb., have been described from the region of the Cape, and there may well be others yet to be discovered.

Pacific Species.

Solenocera novae-zealandiae, Borr. ? (figs. 14 and 15).

At stations 93,120, and 129, all within the area surrounding Three Kings Islands, north of New Zealand, a few *Solenocera* larvae were taken representing two stages in development.

1. The earliest larva (fig. 14), 2·5 mm. long, is a Protozoea without pereiopods or uropods and, while agreeing almost precisely with the larva from station 43 in

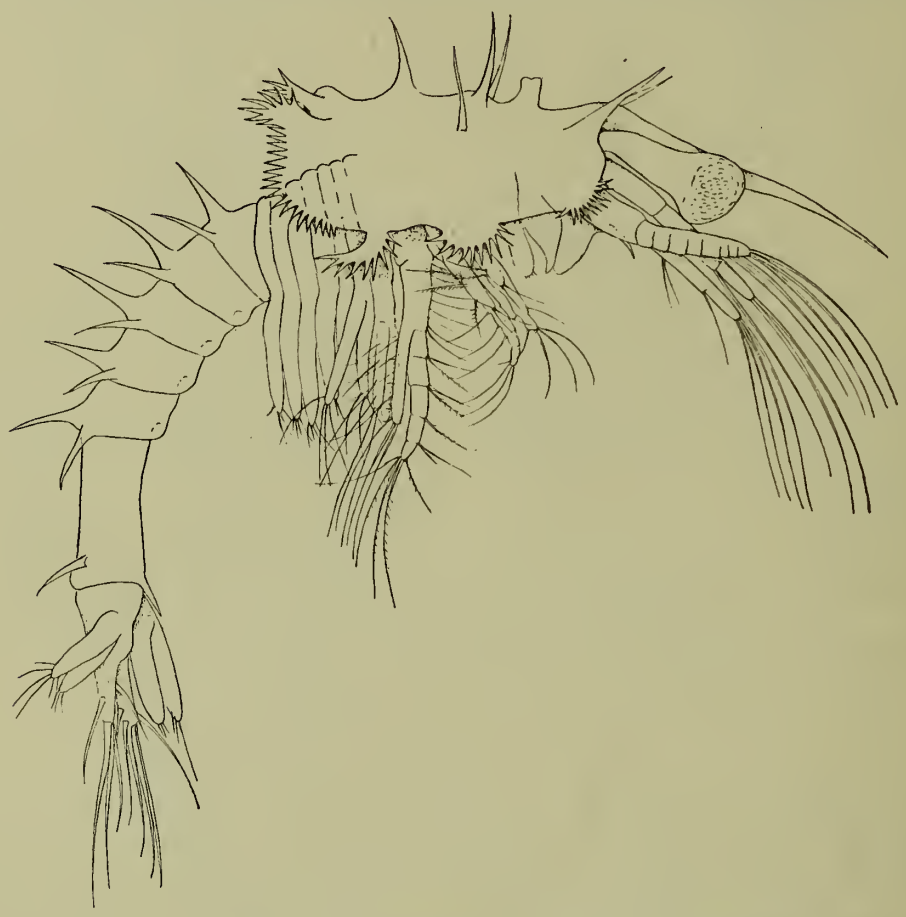

Fig. 15.—*Solenocera novae-zealandiae* (?). Stage II. Station 93.

general structure, it differs in the form of the lateral lappets of the carapace and in the smaller size of the dorsal organ. The abdominal somites are distinct, but without spines.

The eye is very faintly pigmented.

The telson formula is 7 + 7, the two rami not so divergent as in later stages.

2. The older larva (fig. 15), about 4·4 mm. long, possesses rudiments of all pereiopods, and the uropods are present, though shorter than the telson and not yet functional. There is no trace of pleopods.

The abdominal somites are each armed with three long spines except the sixth,

which has two pairs, dorsal and ventral. The arms of the telson are widely divergent and bear sixteen setae in all.

Several species of *Solenocera* have been described from the Indo-Pacific region, but it seems most probable that these larvae belong to the species described by Borradaile from the same district as that in which the larvae were taken.

II. Sergestidae.

1. *Sergestes.*

The history of our knowledge of the development of the genus *Sergestes* has been fully summarized by Wasserloos (1908) and it is not necessary to repeat it here. Since the publication of Wasserloos's paper, Nakazawa (1916) has described the development of *Sergestes prehensilis*, but his paper is in Japanese and is not easily obtainable. So far as concerns the later stages of the Acanthosoma and Mastigopus, Hansen's two reports (1919 and 1922) mark an important advance. In his great work on the Sergestidae of the Atlantic he has been able to connect the Mastigopus with the adult in nearly all the species dealt with, and in some cases has also identified the Acanthosoma stage. For the species of the Indian and Pacific Oceans, however, our knowledge of the larval forms is still most scanty.

While the development of the Sergestidae in all its main features was made clear by Claus and Willemoes Suhm, Wasserloos and Nakazawa alone have been able to follow the whole series of changes in a single species (*S. arcticus* and *S. prehensilis* respectively), and their work is therefore of the greatest importance. Although these larvae are so commonly taken in the plankton of tropical waters, it is impossible from such material to piece together with any certainty the whole series of larvae of any one species. The plankton samples of the "Terra Nova" contain numbers of these larvae in all stages, and in many cases several different stages from the earliest Protozoea to the Mastigopus are to be found in a single sample, but in every case I have found these larvae to belong to more than one species. In such circumstances it is a matter of pure guess-work to connect one stage with another, so great are the changes which take place between the Elaphocaris, Acanthosoma, and Mastigopus. Having regard to the bathymetrical distribution of the adult *Sergestes*, it is probable that the larvae in the older stages will only rarely be found in the same stratum as the younger Acanthosoma and Elaphocaris. Hansen (1922, p. 24) goes so far as to say that a study of the early stages found in plankton samples is not likely to lead to results of any value and should be abandoned. This is probably true from the purely systematic standpoint, but it seems to me that results of some interest are to be obtained from a comparison of the various forms of these early larvae, even if it is not possible to connect them with the adults. I have examined all the larvae with some care and, though from the point of view of the systematist the large amount of time spent has been almost entirely wasted, I think it is worth while to give some account of the early larval types which it is possible to distinguish.

The material at my disposal contains a good number of specimens of the early stages of development, but they are taken from widely separated stations, and, as a rule, but few were taken at any one spot. Although it has not been possible, for the reasons already given, to piece together complete series, I have found that the earliest or Elaphocaris stages differ strikingly in some respects and may be divided into three groups which, for the purposes of description, I define under the names of *Elaphocaris dohrni, E. ortmanni,* and *E. hispida.* I use these names as indicating generic and not specific types, and consider that a description of these types should be of some interest as illustrating the great diversity of larval form within a single and apparently homogeneous genus.

In the larval development of *Sergestes* the following stages may be distinguished.

1. Elaphocaris. This corresponds to the Protozoea of the Penaeidae and includes three stages. In the first stage the eyes are not stalked, but consist of a rather ill-defined area of pigment embedded in the head region. The carapace bears an anterior pair of branched spinous processes, a pair of similar lateral processes, and a posterior median process. The first two pairs of maxillipedes are present as biramous swimming organs and the third is a small uniramous rod.

There can, I think, be no doubt that, at least in the majority of species, this is the first stage hatched from the egg. Nakazawa states that there is a Nauplius stage in *S. prehensilis,* but such a stage has not been seen by Wasserloos or any other observer. The body of the larva at this stage is opaque and appears to contain yolk.

In the second stage the eyes are stalked ; the anterior pair of processes is lost, while a long rostrum has appeared with a number of lateral and ventral spines.

The third stage differs from the second in several respects. The rostrum is flanked by a pair of large branched supra-orbital processes, the thorax bears the full number of rudimentary legs, and the uropods have appeared in a rudimentary form.

2. Acanthosoma. The change of form in transformation to the Acanthosoma is very great, but the mouth-parts retain the same structure. In this respect this stage differs from the corresponding Mysis stage of the Penaeidae.

The spines of the carapace are greatly reduced, but are generally traceable. All the thoracic appendages are present and functional, and the pleopods appear. There are two stages of the Acanthosoma differing only in small details.

3. The Mastigopus differs from the Acanthosoma in the functional development of the pleopods, the great reduction or loss of the carapace spines, and the loss of the fourth and fifth pairs of pereiopods. There is also a complete change in the character of the mouth-parts, which have taken on the adult form. The Mastigopus stage therefore corresponds to the post-larval stage of the Caridea, but persists through a number of moults and is gradually transformed into the adult. (For a full account of those stages, see Hansen, 1922, p. 24.)

I. Elaphocaris.

A. *E. dohrni* (figs. 16–20).

This type of larva was first described by Dohrn (1870), and was later figured by Claus (1876, Taf. VI) and Bate (1888, Pl. LXII).

Fig. 16.—*Elaphocaris dohrni.* Stage I. Station 92.

Larvae of this type occur in the "Terra Nova" collections from many stations, specimens from the Pacific differing in no way from others from the Atlantic, and

it is, I think, certain that larvae of this type belong to adults of several species. There are differences to be found between individual larvae in respect of the number of spines on the rostrum and other processes of the carapace, but these spines are easily damaged and the material is not sufficiently extensive or well enough preserved to allow of any definite distinctions to be drawn. It is sufficient to draw attention to the fact that this is a type of larva common to several species from widely separated stations.

The following description refers to larvae which presumably belong to one species and were all taken at station 92.

Stage I (fig. 16). Individuals of stage I are exceedingly rare, and differ from the similar stage described by Wasserloos for *S. arcticus* and from the *E. ortmanni* and *E. hispida* types in having a rostrum and no antero-lateral processes.

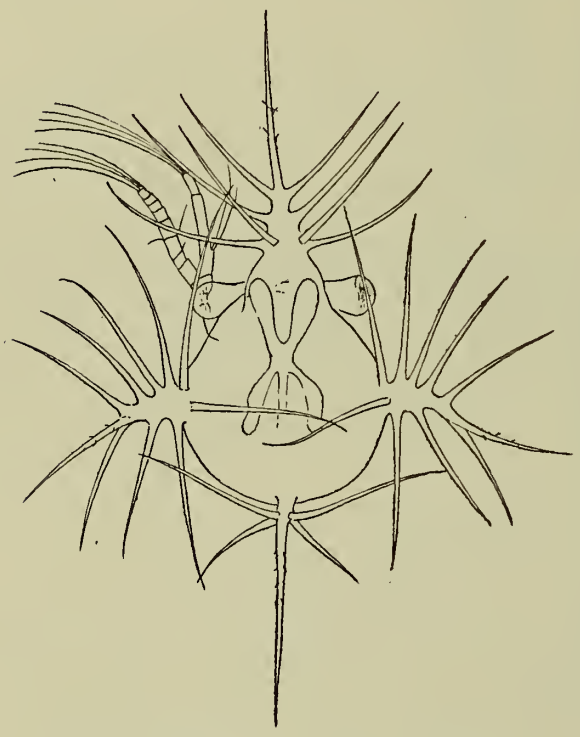

Fig. 17.—*Elaphocaris dohrni.* Stage II. Station 92.

The larva in this stage has very ill-defined eyes, but a pair of very distinct "frontal organs" spring from the ocular region. The rostrum consists of an anterior prolongation of the carapace bearing a long median spine, a pair of lateral spines, and a short ventral spine, all springing from about the same point. The "dorsal organ" is large.

There is a pair of short lateral processes and a posterior process bearing each a median and two pairs of lateral spines. The thorax is segmented and bears a small rod-like third maxillipede, but no pereiopods.

The abdomen is entirely unsegmented.

The telson is forked, each branch bearing six spines, of which four are exceedingly long.

The upper lip is produced into an enormous spine.

Stage II (fig. 17). The eyes are now stalked, but comparatively small, their diameter about half the length of the eye-stalk.

The rostrum now consists of a broad process of the carapace extending forwards beyond the eyes and bearing three pairs of lateral and one pair of dorsal spines. The median, or rostral, spine is itself nearly as long as the carapace. The lateral processes are long and bear ten long spines. The posterior process bears a long median spine and two pairs of lateral spines near its base.

The appendages are unchanged.

The abdomen is partly segmented.

Other larvae in this stage differ in the much larger eyes and in the comparative length, but not in the number, of the spines. At station 50 some larvae of the

Fig. 18.—*Elaphocaris dohrni*. Stage III. Station 120.

following stage were taken which have no posterior median process, but it is possible that this has been broken off.

Stage III (figs. 18–20). All the larvae of this stage, except one to be mentioned below, agree in having large short-stalked eyes. The rostrum varies in the number of lateral and ventral spines. These spines may be all ventral, or there may be one or two pairs of lateral spines, and it is probable that these differences are specific. In the species with which we are now concerned there are two pairs of lateral spines. On

either side, at the base of the rostrum, there is a large supra-orbital process bearing fifteen spines in most cases. Here again, when the number is less, as in a larva from

Fig. 19.—*Elaphocaris dohrni.* Stage III. Station 61.

station 61 (fig. 19), the difference is probably a specific one. The lateral processes also bear fifteen spines, of which some are ventral. The posterior process has four pairs of lateral or latero-dorsal spines.

The telson is forked, each arm bearing four long spines and two short ones.

The pereiopods are all present as biramous rudiments.

The abdomen is segmented, each somite bearing a lateral spine, while the uropods are developed as long biramous rudiments turned forwards.

A larva in the third stage, which is quite distinct from the type above described, was found in the plankton from station 129 (fig. 20). This larva is very much

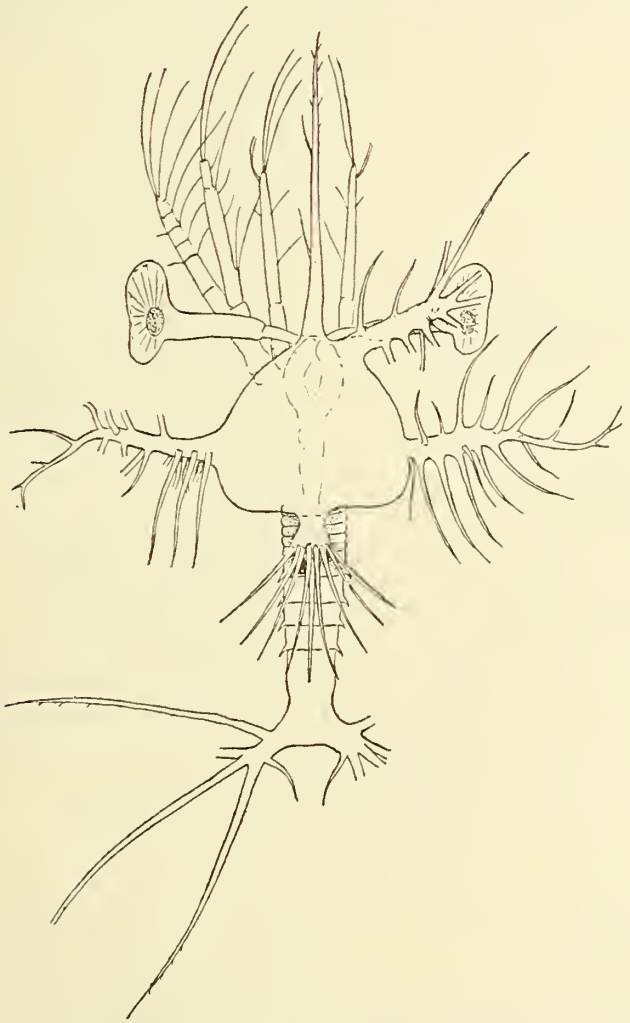

Fig. 20.—*Elaphocaris dohrni.* Stage III. Station 129.

distorted. The eyes are large, on extremely long stalks, and of peculiar shape. The rostrum has neither lateral nor ventral spines. The supra-ocular and lateral processes are not strikingly different, but the posterior process is pear-shaped at its base, where it bears a transverse row of eight spines. In respect of this process it provides a transition to *E. ortmanni.*

The larvae of *S. arcticus* as described by Wasserloos, though differing in detail in several respects from any larvae that I have seen, belong to the *E. dohrni* type.

B. *Elaphocaris ortmanni* (figs. 21–23).

Ortmann (1893, p. 66) briefly described a larva in the second stage which differs from the Elaphocaris of Claus and Bate in having all the spines of the rostral, lateral, and posterior processes arranged in a group at the base of the processes. The same type of Elaphocaris occurs in several of the "Terra Nova" samples, both from the Atlantic and the Pacific, and I have little doubt that they represent more than one species.

Fig. 21.—*Elaphocaris ortmanni.* Stage I. Station 17.

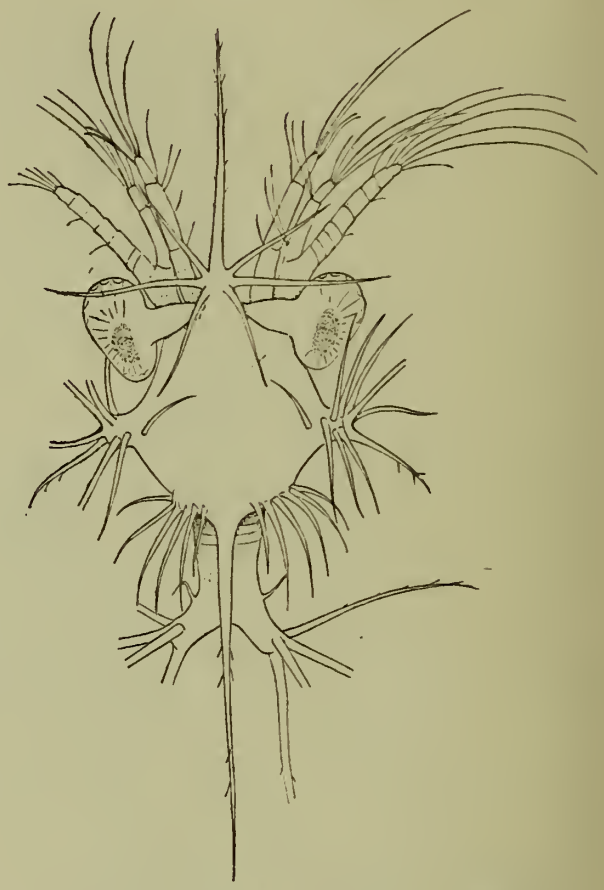

Fig. 22.—*E. ortmanni.* Stage II. Station 17.

Stage I. A larva which I believe belongs to this type was taken at station 17 (fig. 21).

This larva, of which the body measures 0·7 mm., has the usual eye rudiments and frontal organs of this stage. There is no rostrum, but a pair of anterior processes which divide into four long spines. These processes are precisely similar in *S. arcticus*, but there are only three spines in that species. The lateral processes consist of a main spine and three shorter basal spines, while the posterior spine has two pairs of lateral spines at its base.

The telson is of the usual form, forked, and with five spines on each fork.*

* The long spines of the telson of these larvae are usually broken and often lost, so that I give the actual number observed with some reserve.

Stage II. In the second stage (from the same locality), which in the specimen figured (fig. 22) measured 1 mm. in length of body, the eyes are stalked and a rostral spine is present, at the base of which are three pairs of long spines springing from the same level. In place of the lateral spinous process there is now a rounded lateral outgrowth of the carapace upon which a number of almost equal-sized spines are grouped. One of these may in some cases be recognized as the equivalent of the main lateral spine from its bearing denticles, while the others are smooth. The carapace is prolonged posteriorly into a very long spine which projects far beyond the telson, and on either side of it are a number of long spines (six or seven) which form a transverse row across the posterior end of the carapace.

Stage III (fig. 23). In this stage the rostrum is a long unbranched spine, and there are a pair of supra-orbital processes which Ortmann likened to stags' horns. These processes bend at first outwards and then back towards the middle line, and bear a series of spines along their outer margin and a few smaller spines on their inner face at their base.

The lateral processes have now the form of semi-lunar expansions of the carapace armed with a row of spines along their margin. Similarly, there is a posterior spine-bearing expansion at the base of the long posterior spine.

The whole animal is, as it were, a thicket of spines which, in preserved specimens, are often tangled so that the arrangement of them is difficult to make out. This arrangement is, perhaps, best shown in a view from in front (fig. 23).

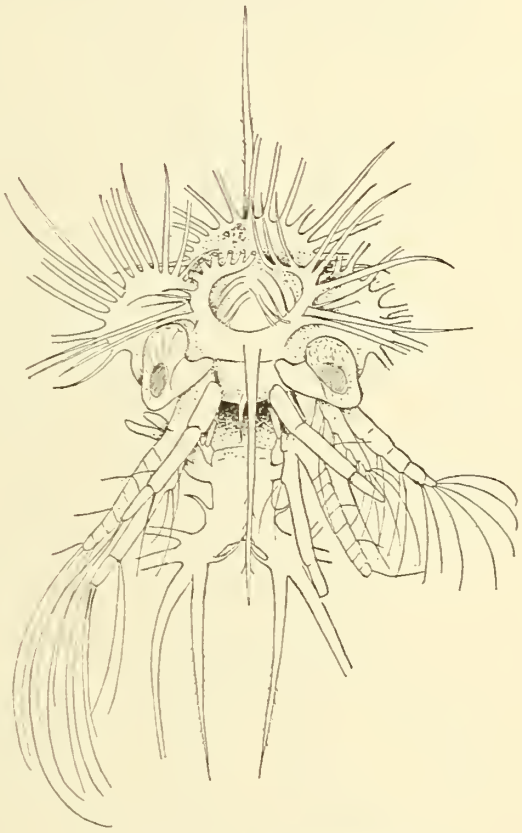

Fig. 23.—*E. ortmanni*. Stage III. Station 87.

C. *Elaphocaris hispida* (figs. 24–28).

The larvae which I distinguish under this name are less common than either of the other types, but occur both in the Atlantic and the Pacific, and certainly belong to different species. One species which has a larva of this type is *S. prehensilis*, Bate, a species found in such abundance in Japanese waters that it is fished on a commercial scale in the Bay of Suruga. Nakazawa* (1916) has figured four

* I am indebted to Dr. Calman for the loan of a copy of this paper, which is in Japanese. To this copy Mr. Nakazawa has added a short MS. abstract in English.

stages in the development, but states that the first larva is a Nauplius. As he does not figure any stage earlier than the first Protozoea described below, and as the available evidence is strongly against the existence of a Nauplius stage in other species, this statement can hardly be accepted without further proof.

I have not been able to follow the metamorphosis through specimens taken at a single station, and the following series must be taken merely as illustrating a generic series.

Stage I. Length of body, 0·73 mm. (fig. 24).

Of this stage I have seen only two specimens, from stations 65 and 66.

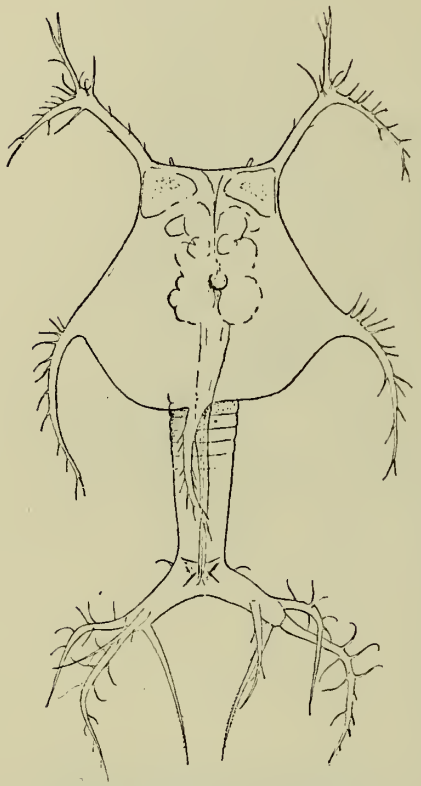

Fig. 24.—*Elaphocaris hispida.* Stage I. Station 65.

The eyes are, as usual, undifferentiated, with distinct frontal organs. The dorsal organ is present. There is no rostrum, but the carapace is produced at each anterior angle into a long narrow process which divides into two branches, the anterior limb short and the posterior limb long and slender. Each branch bears spinules. The lateral processes are long, backwardly directed spines, with spinules along their margin, those towards the base being close-set in a basal group. The posterior spine is much shorter than the abdomen, and likewise bears spinules. The telson is forked, the two arms of it spreading almost at right angles to the line of the abdomen. There is the usual short hooked spine at the base of each branch and four long terminal spines; of these the fourth is slightly curved and is minutely denticulate, while the others, particularly the third, are armed with strikingly long curving spinules.

Stage II. Of stage II I have specimens of two distinct forms, both from station 120. In both of these the eyes are small, round, and with black pigment. This black pigment is a remarkable character since, as Hansen has shown, it is characteristic of the genus that the eye-pigment remains pale till the adult condition is nearly reached, and the colour of the eye is generally a certain indication of maturity.

In both forms there is a small process attached to the inner face of the eye-stalk which seems to represent the frontal organ of the earlier stage. I have seen the same organ in the same position in the first larva of *Philocheras fasciatus* (Gurney, 1903, Pl. V, fig. 1).

In one of these larvae (fig. 25), the body of which measures 1·32 mm., the rostrum is long and simple, without any accessory spines. The lateral spines are likewise simple, backwardly directed, and spinulose. The dorsal spine in this

specimen is broken off. The telson has much the same form as in stage I, but the arms of it have elongated, and there are now six spines in all on each branch, none of which is distinguishable by special armature.

The second larva (fig. 26) does not differ from the first in size, but is distinguished by three characters. At the base of the rostrum there are about five spines on either side on a slight elevation of the carapace. In front of the point of origin of the lateral spines there is a knob-like protuberance of the carapace bearing eight closely packed spines. Lastly, the arms of the telson are short and not greatly diverging.

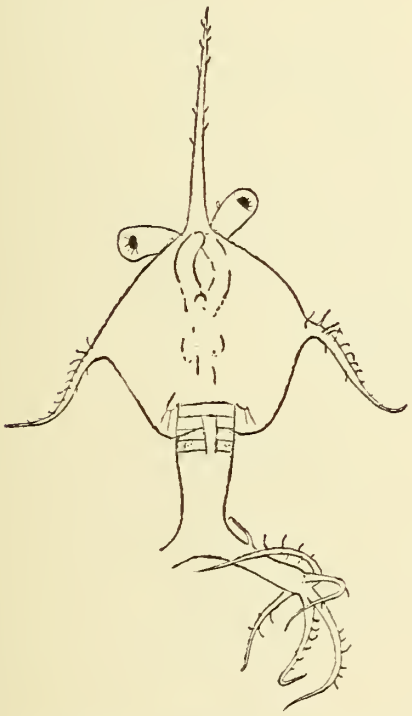

Fig. 25.—*E. hispida.* Stage II. Station 120. Form A.

Fig. 26.—*E. hispida.* Stage II. Station 120. Form B.

The eye-pigment is darker in this form than in the first, both in this and in the next stage.

Stage III. A larva in this stage which can be recognized as belonging to type 1 of stage II is figured (fig. 27). This larva measures nearly 3 mm. excluding the rostrum, and was taken at station 109.

The eye-stalks are very long and slender, and it is characterized by its enormous lateral spines, which are unarmed towards the base. The long rostrum is flanked by a pair of denticulate supra-orbital spines. The arms of the telson are long and divergent, and the spines on them are armed with more or less hooked spinules.

The larva of type 2 unquestionably changes into the form shown in fig. 28. This

larva differs from that above described in the form of the telson, which resembles that of stage II, and chiefly in that of the lateral spines. The lateral protuberance of stage II has become joined to the lateral spine to form a sort of shoulder to it, the spine having the appearance of being fused to the carapace for about one-third of its length, the free part being directed straight backwards.

Both these types of larva differ from *E. dohrni* and *E. ortmanni* in having the uropods much shorter and not curved forwards.

A third form of this larva in the third stage was met with in a sample from

Fig. 27.—*E. hispida.* Stage III. Station 109. Form A.

station 65. In this form the eyes are relatively much larger and the pigment not particularly dark. While the arrangement of the carapace spines is much the same as in type 1, the branches of the telson are excessively elongated and slender.

I have dealt with these early larvae in some detail, since I think it a matter of some importance to establish that within one and the same genus not only are the early larvae of strikingly different types, but also these types represent not species but groups of species. Within the same type—*E. hispida*—the differences between the larvae are as great as, or greater than, those which distinguish genera, or even families within the Caridea (cf. *Processa* and *Pandalus*). It is permissible to suggest that the genus *Sergestes* may be a composite of two or more really distinct genera which have reached a great similarity of form by convergence.

Acanthosoma Stage.

The Acanthosoma stage has been so fully described by Hansen (1922) for a number of the Atlantic species that it is unnecessary to deal with the larvae of this phase in detail. There is great variety among them, but there seems to be but little relation between the type of Elaphocaris and the Acanthosoma into which it is transformed, and it is by no means easy to connect the one with the other.

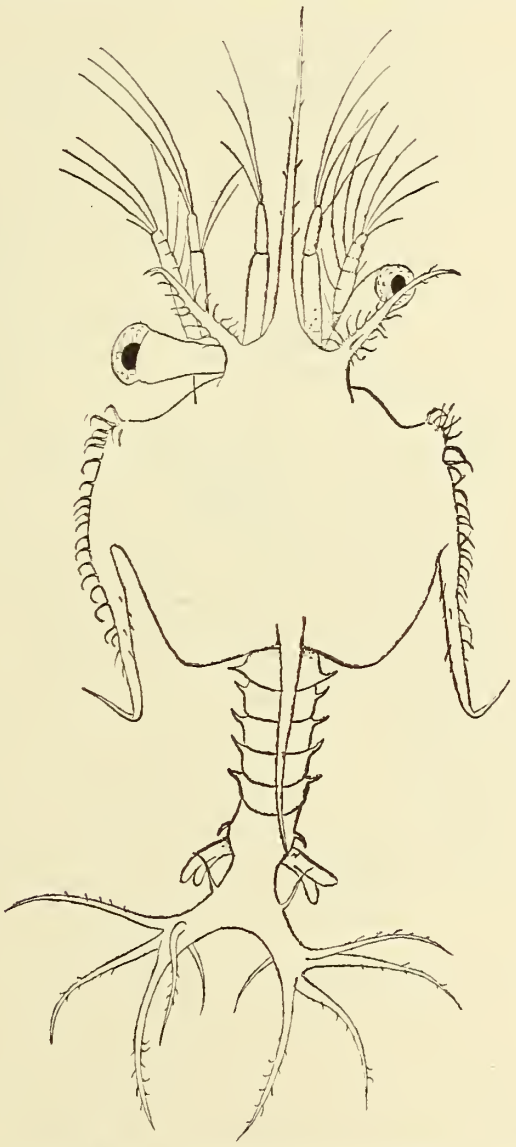

Fig. 28.—*E. hispida.* Stage III. Station 120. Form B.

It is, I think, worth while to describe two types of Acanthosoma belonging respectively to the *hispida* and the *dohrni* type of Elaphocaris for the purpose of showing, firstly, that the very distinct types of Protozoea produce Acanthosomas which are not so distinct, and, secondly, that, although less defined, types may be distinguished at this as in the earlier stage.

I. Acanthosoma of *hispida* type (figs. 29 and 30).

At station 129 a number of Sergestid larvae in later stages were taken, among which several species were represented. Two of these may, with some certainty, be related to the *hispida* type of Protozoea.

Fig. 29.—*Acanthosoma hispida.* Stage II. Example 1. Station 129. *b.* Telson of previous stage.

Example 1 (fig. 29). This specimen is in the second Acanthosoma stage and measures 6·4 mm. from tip of rostrum to end of telson. The rostrum is considerably longer than the peduncle of the first antenna, and is denticulate, with a basal spine. The supra-ocular and lateral spines are present and of some length, and there is a pair of hepatic spines. There is a very small posterior dorsal spine on the carapace.

The abdominal somites have dorsal spines, increasing in size from before back-

wards, and also small ventro-lateral spines. In the previous stage these abdominal spines are very much longer.

The telson is very long and bifurcate, the arms of the fork equalling in length the undivided portion which bears a pair of lateral curved spines.

The eyes are long, round, and with very dark pigment.

The first antennae have the basal joint slightly the longest, and the third joint the shortest.

The second antennae are of the usual form characteristic of the second stage. In the first stage the scale is armed at the end with four stout setae, which differ from the marginal setae and appear less stiff than these (see fig. 30). In the second stage the setae are all alike, and there is a large denticulate spine near the apex of the scale. The endopodite also differs in the two stages. In stage I it is a long unjointed rod with a number of spines at the end, while in the second stage it has become a long jointed flagellum.

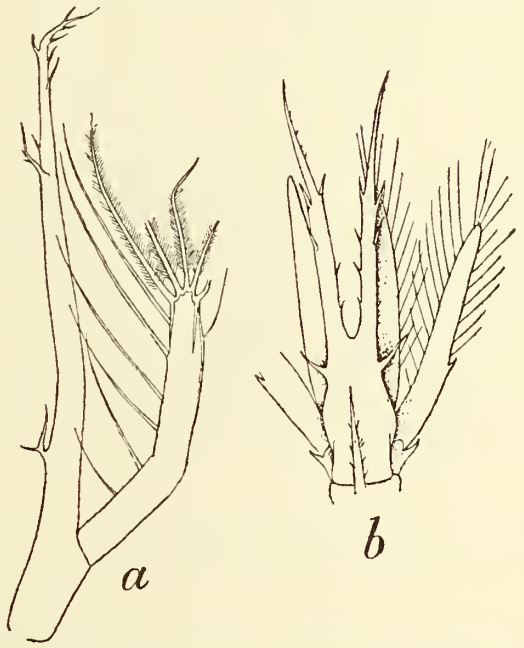

Fig. 30.—*Acanthosoma hispida.* Stage I. Example 2. Station 129. *a.* Second antenna. *b.* Telson.

The mandible has a small palp. The maxillae are much the same as in the Protozoea, but the exopodite of the second pair loses in the second stage all the setae except the posterior one. The maxillipedes and legs are long, slender appendages with long exopodites which, in the second stage, have the setae confined to the distal end. The third pair of maxillipedes in the species under consideration are not of great length, reaching scarcely as far as the base of the antennae. In species which have a very large third maxillipede in the Mastigopus the appendage is noticeably larger also in the Acanthosoma.

The second and third pairs of legs have small chelae. The pleopods are long, the fourth and fifth only having a short endopodite. There seems to be much difference between different species in the stage at which the pleopods become biramous.

The uropods are of characteristic shape, the exopodite narrow at its base and widening distally, the setiferous part of the outer edge scarcely more than half the length of the basal part.

Example 2. A second species, very similar to that just described, was found in the same sample from station 129.

This larva, which is 7·5 mm. long, is in the first Acanthosoma stage, and is

chiefly distinguished from the first species by the narrow lanceolate form of the exopodite of the uropods, of which the setiferous part is more than half the whole length (fig. 30).

The spines of the carapace have a similar arrangement, and the very much greater development of the lateral spines of the abdomen is no doubt largely a matter of age. The spine on the fifth somite reaches back to the end of the long sixth somite. The telson has much the same form, being very long with a long, slender fork.

Acanthosoma of *dohrni* type (fig. 31).*

In the sample from station 129 a form of Acanthosoma was found which I consider belongs to the same species as the Elaphocaris in the same collection, which

Fig. 31.—*Acanthosoma dohrni.* Station 311.

I have described as a peculiar form of the *dohrni* type (see p. 83). This Acanthosoma measures 5·7 mm. including the rostrum, which is 1·4 mm. long, and it is in the second stage.

The rostrum reaches just beyond the peduncles of the first antennae, and has a rather long basal spine. The supra-ocular spines are about two-thirds of the length of the eye-stalks. The sub-ocular spines are long, and there are also hepatic, lateral, and posterior median spines of good size.

The abdominal somites have long dorsal spines and a pair of ventro-lateral spines of which those of the first somite are the longest, while they are reduced to small points on the fifth somite. These lateral spines on somites 1 to 4 are armed with long teeth.

The telson is short, bifurcate, without spines.

* A specimen from station 311 is figured which differs slightly from the description.

The eyes are on long stalks reaching beyond the second segment of the first antenna and are large, oval, with pale pigment. The peduncle of the first antenna is of two joints only, but the position of the line of division between the first and second joints is marked by sensory setae. The first joint slightly exceeds the length of the second, and the second that of the third, all being equally slender.

The third maxillipedes are very large, reaching nearly to the end of the eye-stalks.

The first three pairs of legs show no signs of chelae.

The pleopods are present, all of them except the fifth being uniramous. The fifth bears a minute endopodite.

The exopodite of the uropod is very long and slender, the smooth basal part of the outer margin scarcely more than half the length of the distal setiferous part.

To this Acanthosoma undoubtedly belongs a Mastigopus in the same collection which measures 5 mm. in total length.

In this Mastigopus, which is evidently in the first stage after the Acanthosoma, the rostrum is still long and denticulate, but is not so long as the eye-stalks. It has a very small basal dorsal spine. The supra-ocular and hepatic spines are present, but very small, while the two pairs of lateral spines of the Acanthosoma are still represented by small points. There is a small posterior median spine.

The dorsal spines of the abdominal somites are present but reduced in size, those of the third and fourth being the longest. The lateral spines are lost except for a very small spine on the fifth somite. The telson is short, with two small terminal points.

The eye-stalks are very long, reaching nearly to the end of the second segment of the first antenna. The joints of the peduncle in the first antenna are of about the same proportional length as in the Acanthosoma.

The third maxillipedes are of enormous length, reaching beyond the end of the first antenna, but the last joint is not divided. The arrangement of the setae indicates a later division into three joints.

Legs 4 and 5 are represented by minute buds.

The pleopods are, as in the Acanthosoma, all uniramous except the fifth which has a minute endopodite, but all bear setae and are functional.

The exopodite of the uropod has the smooth basal part about half the length of the setiferous part.

An older Mastigopus of the same species of 8 mm. length has a little black pigment in the eye, but does not differ materially from that just described. The endopodite has appeared as a bud on the third and fourth pleopods. The ventral marginal spines of the carapace are retained.

It would be possible to multiply descriptions of Acanthosoma and early Mastigopus stages, of which there is great variety in the collection, but there is little

advantage in doing so unless these stages can be referred to the adult species. This I have, as a rule, found to be impossible from the material at my disposal, largely owing to the fact that the Mastigopus stages are, almost without exception, seriously damaged. In almost every individual the third maxillipede, which is of such great systematic importance, is broken off, and generally all the legs also are missing. A few species however have, with the aid of Hansen's admirable monograph, been identified, either as Acanthosomas or Mastigopus.

Sergestes crassus, Hansen.

A specimen of a Mastigopus 4·35 mm. long was taken at station 50, which certainly belongs to *Sergestes crassus* according to Hansen's description, though it

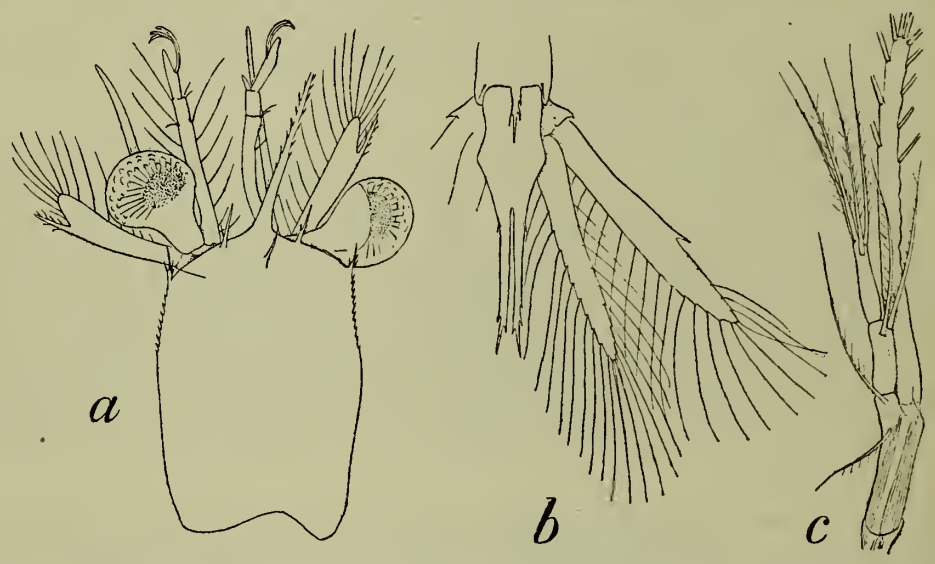

Fig. 32.—*Sergestes crassus*. Acanthosoma, stage II. *a*. Carapace. *b*. Telson. *c*. Leg 5.

represents rather an earlier stage than that figured by him (Pl. VI, fig. 1). In the same sample was an Acanthosoma which, from the structure of the telson and shape of the eyes, I consider to belong to the same species. Unfortunately, the abdomen of the specimen was so damaged that I can only figure the thorax and telson (fig. 32).

The width of the thorax is about two-thirds of the length, the rostrum, which is closely denticulate, being about as long as the antennular peduncle. At its base is a rather long median spine, but the supra-ocular spines are very short.

The ventral edge of the carapace bears anteriorly a series of about ten teeth, and is prolonged at its anterior angle into a short sub-ocular spine. There are no lateral, hepatic, or posterior median spines.

Each of the abdominal somites bears a dorsal and a pair of ventro-lateral spines.

The telson is long and narrow, and deeply cleft into two parallel branches (fig. 32, *b*).

The eyes are shortly stalked and nearly round, the pigment rather dark.

In the exopodite of the uropod the smooth basal part is about one and a half times as long as the setiferous part, and is separated therefrom by a large tooth.

Sergestes vigilax, Stimpson.

Stations 12 and 65.

S. pectinatus, Sund.

Station 50. Mastigopus.

S. cornutus, Krøyer.

Station 65. An adult male in fragmentary condition, but recognizable from the structure of the petasma.

2. *Petalidium foliaceum*, Bate ?

The reasons which have led me to regard the larvae described below as belonging to *Petalidium* will be given later.

A similar type of larva has already been met with more than once, but, as only the first stage was seen, no reference to its systematic position was possible. The first description is that of J. V. Thompson (1828), who figured (Pl. I, fig. 4, *a* and *b*) a peculiar larva taken in 17° 30′ S., 1° 30′ W., which was "discovered by its luminous scintillations in the dark." In 1871 Dohrn described and figured (Pl. XXX, fig. 53) a Zoea of unknown origin and affinity from the Indian Ocean which evidently belongs to the same genus, and a similar larva was again figured by Claus (1876, Taf. IV, fig. 2) as a "Phyllopod-like" Protozoea of unknown origin. Finally, the same form was met with by Lister (1899), who doubtfully referred it to a stage in the development of a Stomatopod. Lister's description of his larva as a Metanauplius was not founded on a detailed examination, since the single specimen had been lost at the time his note was written and he was only able to say, from his notes made thirteen years before, that "rudimentary" appendages to the number of "perhaps three" were situated behind the antennae. The appendages are not easy to make out, and I have no doubt that some were overlooked, and that the larva was not in a Metanauplius stage. It is still more certain that it had no relationship to the Stomatopoda. Lister's figure has been reproduced by MacBride in his *Text-book of Embryology* (1914, p. 217), and its designation as a Metanauplius belonging to the Stomatopoda is accepted. It is for this reason important that it should be made clear, not only that the evidence was originally insufficient, but also that the rediscovery of the same larva definitely proves Lister's conclusions to have been wrong.

Brooks (1882) suggested that Claus's and Dohrn's larvae might represent early stages in the life history of *Acetes*, a guess which was remarkably near the truth.

In the plankton sample taken by the "Terra Nova" at station 251 a large number of larvae were taken in several stages, and a single specimen was also taken at station 129. I am able therefore to give a description of the whole course of development up to an early Mastigopus stage.

Stage I. Length (from end of rostrum round curve of body), 2·7 mm. (fig. 33, *a* and *b*).

The smallest larva found has a very peculiar appearance, the body being usually curled round so that the abdomen is completely covered by the dorsal shield. The latter is very large, with a large rostrum bent downwards at right angles in front of

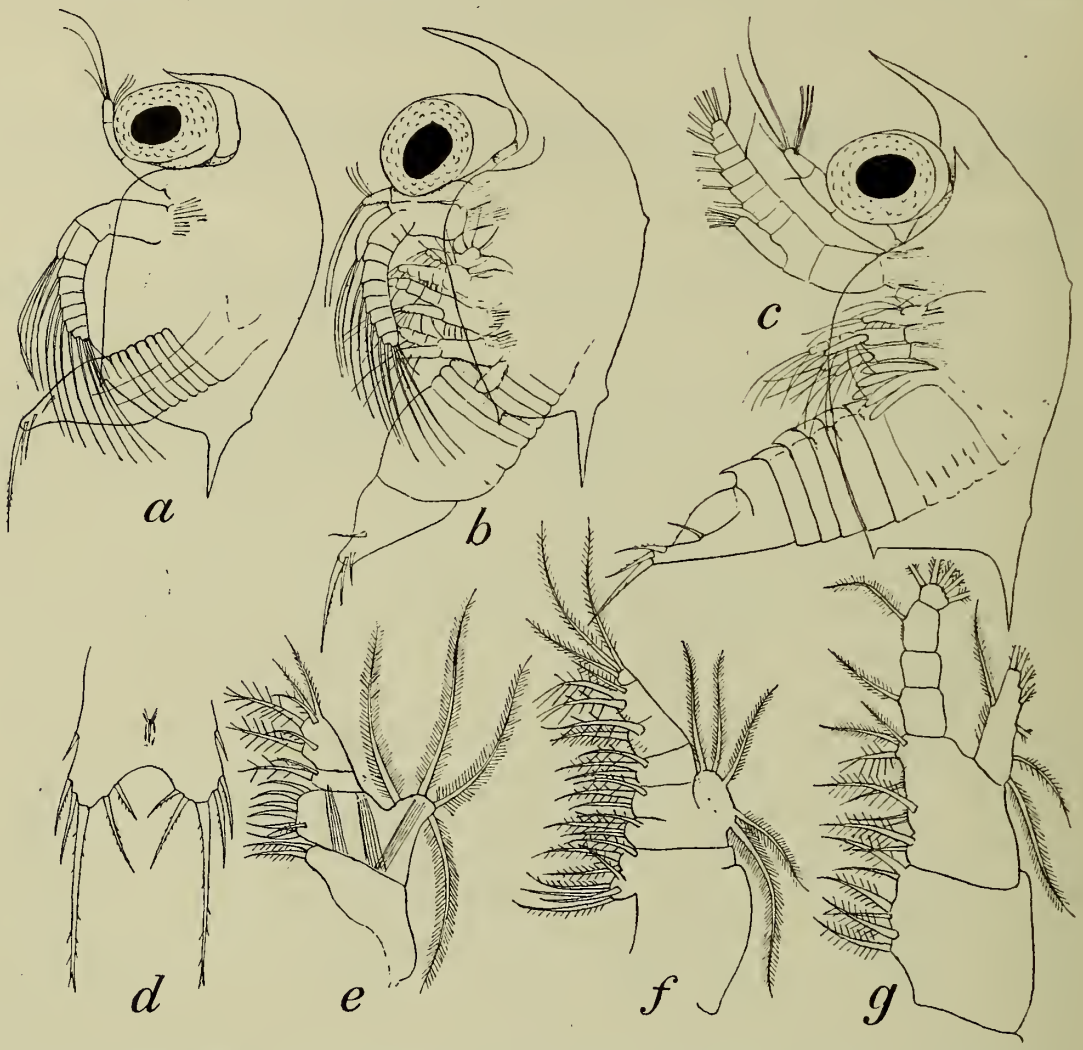

Fig. 33.—*Petalidium.* *a* and *b*. Stage 1. *c*. Stage II. *d*. Stage I. Telson. *e*. Stage III. First maxilla. *f*. Stage III. Second maxilla. *g*. Stage III. First maxillipede.

the eye, and produced backwards into a stout posterior spine. The ventral edge is nearly straight, ending behind in a small spine.

The abdomen is short and unsegmented, terminating in a slightly forked telson. The telson bears one large spinous seta and five shorter setae, three on the outer and two on the inner side of it.

The thoracic region shows rings corresponding to the five somites of the pereion and the third maxillipede.

The eyes are very large and stalked.

The appendages have the same form throughout larval life and will be described in detail under stage III. At this first stage the first two pairs of maxillipedes are fully developed, and the third is present as a small simple rod.

Stage II. Length, 3·5 mm. (fig. 33, *c*).

The general form is the same, but a short, stout supra-orbital spine has appeared.

The thorax and abdomen are now fully segmented, and short rudiments of all the pereiopods are present, the third pair being the largest.

The abdominal somites have epimera which are produced each into a backwardly turned point. The pleopods are not visible. The telson is of the same form as before and has the same number of spines, but the uropods have now appeared as large functionless appendages, without setae, and almost hidden beneath the telson.

Stage III. Length, 4·4 to 4·56 mm.

The form of the carapace remains the same, but the abdomen is greatly elongated and entirely uncovered by it. Even the last somite of the pereion is uncovered.

On the abdomen the first signs of the pleopods appear as simple ridges. The telson is unchanged, and the uropods are still functionless and without setae.

The first antenna has a three-jointed stem and a small terminal joint which bears two distal setae and four aesthetes in two pairs.

The second antenna is a powerful swimming limb, the exopodite being divided into eight joints of which the six terminal joints each bear a long seta. The endopodite is one-jointed and bears four terminal setae.

The mandible is not cleft, but the chewing edge is distinguished into a toothed anterior part and a small posterior molar part. There is no palp.

The first maxilla (fig. 33, *e*) consists of the usual spine-bearing coxopodite and basipodite, the latter bearing a distinct exopodite with four long ciliated setae. The endopodite is two-jointed and armed with stout spines.

In the second maxilla (fig. 33, *f*) the coxopodite and basipodite are distinct, and each has two inner lobes armed with spines. The exopodite is small and bears five long setae. The endopodite is stout and four-jointed.

First maxillipede (fig. 33, *g*). The two basal joints bear a number of stout spine-like setae. The exopodite is shorter than the endopodite and has eight long swimming setae. The endopodite is four-jointed and well developed.

The second maxillipede has no setae on the basal joint and only three slender setae on the basipodite. The exopodite bears only five setae, and the endopodite is obscurely three-jointed.

The third maxillipede is a biramous rudiment without setae. All the pereiopods are present as biramous rods without setae. There are a number of specimens of this stage, and they differ a good deal among themselves in size and degree of development of the pereiopods. Possibly there is more than one moult.

Stage IV. Length, 6·8 mm. (fig. 34).

With the moult from stage III the whole appearance of the animal is entirely changed, but that stage III does give rise directly to stage IV is conclusively proved by the examination of two specimens which were found actually in the moult from the one stage to the other. In one of these, measuring 5·8 mm., the carapace, antennae, mouth-parts, and telson were as in stage III, but the cuticle had been stripped off some of the pereiopods and the anterior part of the abdomen, revealing setiferous exopodites on the former and long pleopods on the latter.

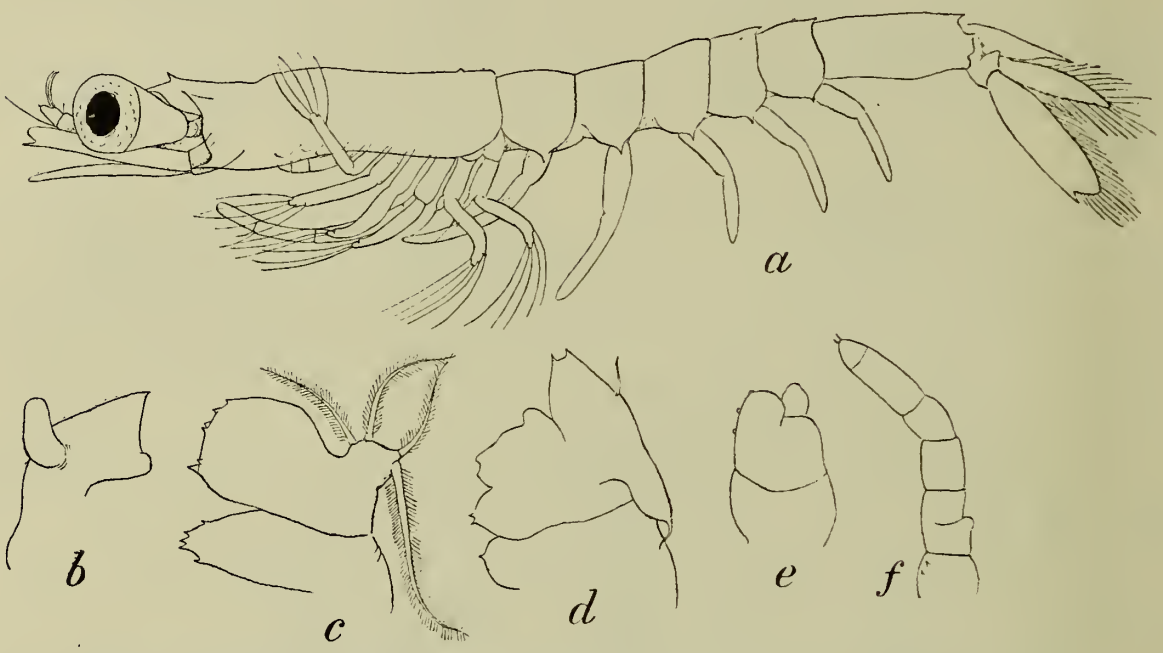

Fig. 34.—*Petalidium*. Stage IV. *b*. Mandible. *c*. First maxilla. *d*. Second maxilla. *e*. First maxillipede. *f*. Second maxillipede.

In stage IV the larva has taken on the general appearance of a Sergestid Mastigopus, with long slender thorax and abdomen.

The rostrum is short with a large basal tooth ; the supra-ocular spine is retained, but two new spines have appeared, namely, an hepatic, and a sub-ocular at the anterior angle of the carapace.

The epimera of the abdominal somites are pointed, and somites 4, 5, and 6 have very short dorsal median spines. The telson is considerably shorter than the uropods, and bifurcate. It has somewhat the form of a Sergestes telson, with sinuate outer edge and a small lateral spine about half-way along its edge.

The first antennae have a stout three-jointed stem, but the line of division of the first and second joint is not clear and may only be marked by a row of sensory setae. The inner branch is represented by a minute bud.

The second antenna has completely changed its appearance, the scale now having

the ordinary "Caridean" form, somewhat widening distally and with a strong terminal spine. The inner branch is a simple rod, shorter than the scale.

The mandibles (fig. 34, *b*) have a smooth cutting edge and have developed a rudiment of the palp.

The remaining mouth-parts have suffered a very remarkable degradation and appear to be quite functionless.

The first maxilla (fig. 34, *c*) consists as before of two large lobes with an exopodite bearing four long setae, but the lobes have neither setae nor spines, and the endopodite has disappeared.

The second maxilla (fig. 34, *d*) likewise has lost all setae and spines from its inner lobes, and the endopodite is reduced to a minute papilla. The basal joint of the appendage bears a single inner lacinia, and the basipodite bears two inconspicuous lobes. The exopodite is large, but has lost its setae. In the appendage drawn two very short setae remain.

The first maxillipede (fig. 34, *e*) is reduced to its two basal joints which lack all setae. The exopodite is entirely gone, but the endopodite is still represented by a small papilla.

The second maxillipede (fig. 34, *f*) has also lost setae and the exopodite, but the endopodite consists of a five-jointed appendage without setae.

The third maxillipede is functional and bears a large exopodite with five terminal setae and a five-jointed endopodite with a terminal spine.

Each of the five pairs of pereiopods has an exopodite with five setae, the endopodites of the first two pairs resembling the third maxillipede but being four-jointed. The endopodite, however, of the third leg is of enormous size, reaching forwards beyond the mouth and consisting of four joints. The terminal joint is long and bluntly pointed, without claw or setae. The endopodites of the fourth and fifth legs are small papillae, each with a single seta.

I have seen no trace of gills.

The pleopods are all present and are large, decreasing in size from before backwards. They bear no setae and the endopodite is absent. The uropods are large and setiferous, the exopodite broad and with an outer terminal spine.

This stage seems to correspond to the Acanthosoma stage of *Sergestes*, but the complete reduction of the mouth-parts is a character which is quite exceptional.

Stage V. Length, 7·8 mm. (figs. 35 and 36).

The general form is unchanged, but the mouth-parts have more or less recovered their function.

The eyes are longer and more slender. The two pairs of antennae differ little from the preceding stage except that the inner branch of each is a little longer.

The mandible (fig. 36, *a*) has a large one-jointed palp with five setae.

The first maxilla (fig. 36, *d*) has lost the exopodite which is now represented only by a small knob, but the two inner lobes bear setae and spines and are evidently functional.

The second maxilla (fig. 36, *c*) is not altogether easy to interpret. It appears that the two lobes which are retained belong to the basipodite and that the lobes of the coxopodite are lost altogether. The endopodite is reduced to a small knob. The exopodite is large and bears six setae.

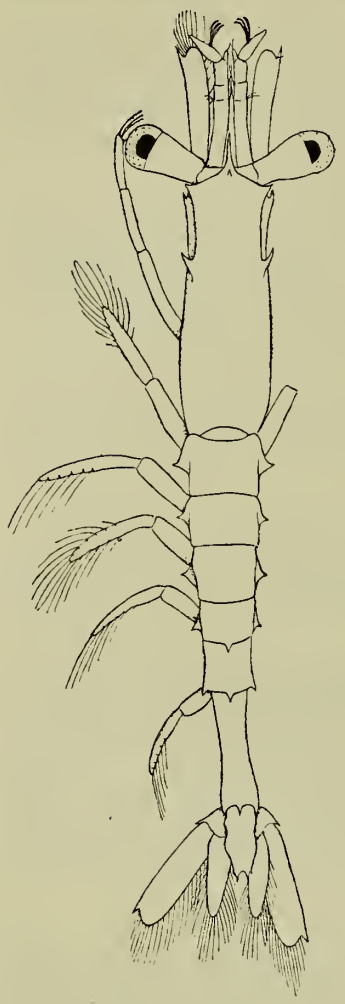

Fig. 35.

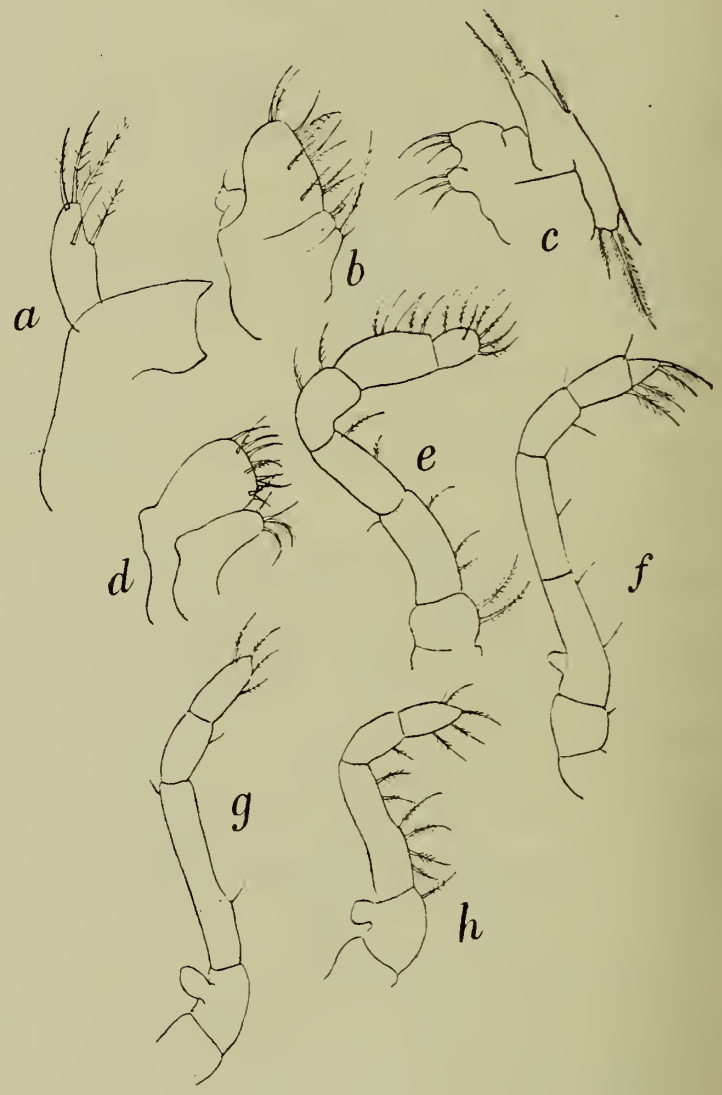

Fig. 36.

Fig. 35.—*Petalidium.* Stage V.

Fig. 36.—*Petalidium.* Stage V. *a.* Mandible. *b.* First maxillipede. *c.* Second maxilla. *d.* First maxilla. *e.* Second maxillipede. *f.* Third maxillipede. *g.* Second leg. *h.* First leg.

The first maxillipede (fig. 36, *b*) has redeveloped setae on its inner lobes, but the exopodite has disappeared and the endopodite is reduced to a peculiarly bent papilla.

The second maxillipede (fig. 36, *e*) likewise has no trace of an exopodite, but the endopodite is a large five-jointed appendage fully provided with setae.

The third maxillipede (fig. 36, *f*) has a trace of the exopodite, and the endopodite is very long and five-jointed.

The pereiopods have all lost their exopodites except for a small papilla on the basipodite. The endopodites are four- or three-jointed, the first and second joints not being clearly separated (fig. 36, *g*, *h*). The third leg is an enormous appendage reaching forward nearly as far as the end of the eye. It is of six joints, and the terminal joint bears several stiff curved setae. The fourth and fifth legs have disappeared.

The pleopods are still uniramous, but are clothed with setae.

The gills are scarcely developed, but there appears to be a single gill in the position of a pleurobranch on the somites of the third maxillipede and first three legs.

This stage evidently corresponds to the early Mastigopus of *Sergestes*, and the extraordinary hypertrophy of the third leg recalls the large third maxillipede of Hansen's group II.

Not only in general form of body, but also to some extent in the course of its development, the larva described above differs greatly from any hitherto known. It is unfortunate that the series of stages, complete and consecutive as they are through a number of moults, should stop short before the appearance of distinctive generic and specific characters. That it is the larva of a Sergestid is certain, but it cannot be referred without some doubt to any known genus.

Stages I to III correspond in the number of appendages to the Elaphocaris of *Sergestes*, and the agreement in structure is almost exact, with the exception that the appendages are less slender. Stage IV cannot, however, be exactly compared with any stage in the development of *Sergestes*. In the development of all the pereiopods with natatory exopodites it agrees with the Acanthosoma stage, but in other respects it may more properly be compared with the Mastigopus. The Acanthosoma stage has, in fact, been dropped out of the series, and has been replaced by a larva of unique character intermediate between the Acanthosoma and the Mastigopus. The second maxilla and the first maxillipede are reduced in a remarkable way, but still their structure is recognizably similar to the shape of the corresponding appendages in the Mastigopus, having lost entirely the primitive protozoeal form and approximating to that of the adult.

Stage V, on the other hand, reveals itself as distinctly a Mastigopus of *Sergestes* or an allied genus. Not only is the general facies the same, but the appendages, which have now recovered their setae, are obviously those of a Sergestid, though details might be pointed out in which they differ from those of any known *Sergestes*. How far such differences are likely to be carried on to the adult and whether they are to be regarded as generic or not it is impossible to say. We know the Mastigopus stages of many species of *Sergestes* and the earlier stages of some, and these are so uniform in general character that it is unlikely that any species of *Sergestes* could depart so much from the normal type as the larvae above described. There remain the genera *Sicyonella*, *Petalidium*, and *Acetes* as possibilities.

Of the development of *Sicyonella* we know nothing, but Brooks (1882, p. 101) * has described stages in the development of *Acetes* and Hansen the Mastigopus of *Petalidium*.

The larva of *Acetes*, as figured by Brooks, has a certain resemblance to that of *Lucifer* and agrees with the "Terra Nova" form in having a carapace with median, dorsal, and posterior lateral spines. On the other hand, it differs in its greater slenderness, absence of the pronounced ventral flexure of the body, and in various details of the appendages and telsons. But the later course of the development as described by Brooks makes it perfectly clear that the larva in question does not belong to *Acetes*, since the stage corresponding to the Acanthosoma in *Acetes* differs in almost every respect from stage II of my series. It is not necessary to enter into details, but I may refer to Brooks's Pl. II, fig. 84. Brooks himself claimed Dohrn's and Claus's larvae as Sergestids and suggested that they might represent earlier stages of *Acetes*, but there can be no doubt at all that they belong to some other genus of the family.

The description of the early Mastigopus of *Petalidium obesum* by Hansen (1922, p. 195) is taken from an older stage than my own latest larva, as shown by the condition of the first antennae, but it is smaller (5·5 mm.). Hansen does not figure either the whole animal or the mouth-parts, but his description tallies so nearly with the "Terra Nova" species that I am convinced that the latter can with reasonable probability be referred to the genus *Petalidium*. Whether it may belong to *P. foliaceum* or to an undescribed species it is of course impossible to say, but I have attributed it provisionally to the former.

The characters upon which the generic determination may be made are as follows:.

1. Antenna. Stem short and stout as compared with Sergestes, the basal joint longer than the two distal joints combined.
2. Antennal scale rather broad, parallel-sided, with large terminal spine.
3. Eyes short, pear-shaped.
4. Supra-orbital, sub-orbital, and hepatic spines well developed.
5. Third maxillipede little longer than second.
6. The first leg shorter than the third maxillipede, but the third leg enormously prolonged, six-jointed, the two terminal joints long and slender. The last joint without chela, and bearing a tuft of stout spines.
7. Exopodite of the uropods broad, setiferous only along inner and terminal margins. Outer margin terminating in a spine.

3. *Lucifer*.

Early larvae of *Lucifer* are very rare in the "Terra Nova" collections, but occur singly at stations both in the Atlantic and Pacific. The material is not sufficient to

* Brooks does not claim his larva definitely as that of *Acetes*, but the probability of his identification being correct is very great, and it may be accepted.

permit of any comparison being made between the larvae of different species or to add anything to our knowledge of the development of the genus of which such an excellent account has been given by Brooks (1882).

CARIDEA.

Throughout the large group of the Caridea the larvae are not only extraordinarily alike in general structure, but pass through an almost precisely similar series of stages, and it is exceedingly difficult to find characters by which those of the different families may be distinguished. It is true that many of the larvae possess striking and distinctive features, but these as a rule are due to characters of minor importance, and are generic or specific and seldom available for the characterization of larger groups. In some cases, as for example among the Crangonidae,* the larvae of different species are even more unlike than the adults, while in other cases, as in the genus *Leander*, it is almost impossible to distinguish species, whereas the generic characters are well defined. The relationship of the families of the Caridea to one another is most obscure, and at the present moment but little light can be shed upon the subject by their ontogeny.

In all the Caridea with a complete larval series of which the whole course of development is known, the first three stages are so precisely alike in respect of certain characters that it is difficult to avoid feeling that there must be some phylogenetic significance in the fact. Invariably the first larva has sessile eyes and no spines on the carapace, whereas the second larva has the eyes stalked, and spines, when present at all, make their appearance. The uropods always appear first in the third stage, and at this stage always have the endopodite more or less undeveloped. I do not know of any exception to this rule, except in the case of those species, such as certain Palaemonidae and Crangonidae, in which an excess of yolk leads to an abbreviation of larval life. When development is so abbreviated the larva hatches with all the appendages present, the only exception being the uropods, which in such cases are always delayed. A retardation in the appearance of the uropods seems to be in some way correlated with abbreviated metamorphosis, and is not peculiar to the Caridea (cf. *Axius stirhynchus*, *Calocaris macandreae*, *Homarus*, *Nephrops norvegicus*), but it may perhaps be regarded not so much as an abnormality as rather a reversion to the primitive order of the appearance of appendages, since these appendages do not appear till after the pleopods in some cases where development is not abbreviated in this way—*Porcellana*, Brachyura.

The larvae of the Caridea, while readily recognizable as such, are not easily defined when compared on the one hand with the Mysis stage of the Penaeidea, and on the other with those of the Thalassinidea. The possession of only six pairs of setae

* It is necessary to note that *Crangon* and Crangonidae are here used in their older and more usual sense. Miss Rathbun's transference of these names to the Alpheidae should be ignored.

on the telson of the larval cuticle has been already mentioned as an important distinction. The chief characteristic of all is that they invariably possess three pairs of biramous maxillipedes on hatching (except when larval life is abbreviated). The pereiopods appear and become functional in succession and not simultaneously; two or more pereiopods bear exopodites; the rostrum is never horizontally flattened; the second maxilla has usually only three inner lobes; the antennal scale is usually jointed; the third abdominal somite is usually larger than the rest; the abdominal somites usually lack dorsal spines.

Of the sixteen families of Caridea nothing at all is known of the development of seven, while of the remainder our knowledge is, for the most part, scanty, generally only one genus or even species being known in each. It is true that in most cases the larval characters of a family may be satisfactorily illustrated by any given species within it, but this is not always so.

For example, the development of *Hippolyte varians* is certainly not typical for the great family of Hippolytidae, differing as it does greatly from that of *Spirontocaris*, and even more from *Lysmata seticaudata*.

Many Caridean larvae have been described by Bate, Ortmann, and others under generic and specific names, and, as the descriptions are often incomplete, it is generally impossible to assign them with any certainty to their appropriate families. Coutière (1907) has attempted to group some of them under families, and with his determinations I am in general agreement.

The "Terra Nova" collections naturally contain a number of Caridean larvae, but a large proportion of them are in early stages which are indeterminable and may be ignored. Some which would otherwise be of interest are so damaged as to be useless, but there remain a few which seem worthy of notice.

I. Amphionidae.

Amphion.

The systematic position of *Amphion* is still a matter of complete uncertainty. The most recent discussion of the question is that of Koeppel (1902), who gives a summary of the literature, and concludes that *Amphion* attains maturity without further transformation and should be placed among the Sergestidae. For neither of these conclusions is the evidence given at all satisfactory, and it does not seem that Koeppel's work advances our knowledge materially. His statement that he found traces of "brood lamellae" on the appendages is not confirmed by his figures, and is not consistent with the inclusion of the genus in the Decapoda. There can be no doubt that none of the specimens of *Amphion* so far described can be regarded as adult, but whether any great transformation occurs or is to be expected is a matter for speculation.

The general similarity to a Phyllosoma is very obvious, and Boas's view that *Amphion* represents the larva of *Polycheles* is not to be dismissed lightly. Sund

(1915) has claimed *Eryonicus* as the larva of *Polycheles*, but this is not accepted by Selbie (1914) or Bouvier (1917). Bouvier's argument against Sund's view is convincing, and there still remains therefore the possibility that *Polycheles* has a free larva which might resemble *Amphion*. On the other hand, Selbie has described (1914, p. 40) an immature stage of *Eryonicus* which is of great importance in this connexion. This specimen has practically the adult form, but has a long rostrum, much reduced antennae, and two pairs of pereiopods only, both of which have exopodites, but are otherwise fully developed. Now, having regard to the near relationship of *Eryonicus* and *Polycheles*, it is to be expected that both would have at least approximately the same course of larval development ; but, if that is so, a form like *Amphion* can have no place in it. *Amphion* differs totally from this early stage of *Eryonicus* in almost every respect, and particularly in having, in its oldest stage, all the pereiopods present and yet none of them fully differentiated. Although I admit that the assumption that *Eryonicus* and *Polycheles* should have much the same larval development is no very secure foundation for an opinion, it seems to be justifiable, and its acceptance involves the conclusion that *Amphion* is not the larva of *Polycheles* or of any other known Reptantia.*

It cannot be included within the Penaeidea. The youngest known *Amphion* has three pairs of maxillipedes only and no trace of pereiopods, while at the same time the appendages have none of the characters of those of the Penaeidea at an equivalent stage.

The only remaining group to which *Amphion* may belong is the Caridea, and it seems to me that it is with some confidence to be there placed. This position has already been assigned to it by Korschelt and Heider (1892, vol. ii, p. 46), chiefly on the ground of its possession of phyllobranchs in the oldest observed stage. The only serious difficulty in the way of such a conclusion is the dendritic form of the liver diverticula which so closely resembles those of Phyllosoma, and the absence (according to Koeppel) of pleopods from the first abdominal somite. The latter may probably be dismissed, as Bate and Claus both show an appendage on this somite in late stages, though Bate mentions its absence in a specimen of 15 mm. Apart from these two characters, on neither of which much stress can be laid, there is nothing to exclude *Amphion* from the Caridea, and it has a considerable degree of similarity to the "Eretmocaris" larva, which probably belongs to the Latreutidae. The great length of the coxopodite of the maxillipedes and pereiopods is, it is true, a feature not found in other Caridea, but it is probably a special adaptation. The structure of the mouth-parts fully resembles that of Caridea, and the presence of only three inner lobes on the second maxilla is, in this connexion, a character of much importance. (See Claus, 1876, Taf. VIII, figs. 9, 10.)

Whether *Amphion* is to be regarded as a larval form of any known Caridean is another matter. Koeppel states that the rudiment of the fifth pereiopod is biramous,

* *Willemoesia* has an abbreviated development according to Doflein (1904).

and, if this is really so, it could only belong to the Hoplophoridae or Pasiphaeidae, to neither of which does it otherwise bear any resemblance. The oldest known stage is so near maturity that the most reasonable conclusion is that the genus *Amphion* includes larval and adolescent stages of a Caridean, the adult of which is at present unknown and which is probably not referable to any existing family.

Three specimens of this peculiar form were taken by the "Terra Nova" at stations 62, 65, and 66 (Atlantic), in each case at the surface and between 1.30 and 2.30 a.m.

They are all young individuals about 5 mm. in length, and represent stages intermediate between the two figured by Bate (1888, Pl. CXLVI, figs. 1 and 4), having three pairs of maxillipedes only developed, but the uropods already present. In one of them the first pereiopod is represented by a small bud. The telson still has the rounded form of the earlier stage.

In Bate's account of the genus no less than ten different stages may be separated, while the "Terra Nova" specimens represent an additional stage not taken by the "Challenger." These specimens, however, do not throw light on the systematic position of the genus, and any further description is unnecessary.

II. Hoplophoridae.

In *Acanthephyra* (*Systellaspis*) *debilis* (Coutière, 1906) and *Hymenodora glacialis* the eggs are of very large size and the development is abbreviated, but *A. purpurea* hatches as a normal Zoea and passes through a series of stages similar to those of other Caridea (Kemp, 1907). The larva described by Coutière (1907) under the name of *Hoplocaricyphus similis* has been ascribed to *A. multispina*, and this is perhaps correct since it is evidently an *Acanthephyra*, but is distinct from the larvae described by Kemp and ascribed by him to *A. purpurea*. Stephensen (1923) suggests that Kemp may have been dealing with *A. multispina*, but the distinctness of Coutière's larva is against this supposition.

Coutière has drawn attention to the fact that the larvae of Hoplophoridae develop the mandible palp at an early stage, and the presence of this palp in conjunction with the possession of exopodites on all the legs is a first-rate character for distinguishing these larvae. This palp, however, though appearing earlier than in any other Caridea, is not present in the first four stages of the larva, and can therefore only be used as a distinguishing character in late stages. The peculiar form of the abdomen is not distinctive, since it is shared with larvae belonging to other families (see *Caricyphus*, sp. Kemp, 1907, and below, p. 113).

Larvae which, in reliance on Kemp's and Coutière's work, I attribute to Hoplophoridae, were taken by the "Terra Nova" at the surface at several stations. As the larvae of this primitive family are of rather special interest some description of these should be given.

These larvae are all in rather early stages, as was to be expected, since it is known

that larvae exceeding 5 mm. are practically confined to deep water (Murray and Hjort, 1912, p. 623).

Acanthephyra, sp.

Stations 120 and 122.

Stage I. Length, 2·9 mm.

The rostrum extends to the end of the antennal scale and has no dorsal spine. Immediately behind it is a small knob representing the dorsal organ. The carapace has no pterygostomial spine and its posterior margin is not denticulate.

The abdomen is very long, without spines, and the third somite is large and somewhat protuberant. The telson is triangular, deeply hollowed, and bears fourteen spines.

Second antenna. The basipodite has a large inner spine. The exopodite has two outer setae and five distinct joints. The endopodite is slender, continued without suture into a long spiniform seta. A short slender seta springs from the point at which the suture between endopodite and spine should be present. Mandible without palp.

The first maxilla is of special interest as having on the basipodite a round plate bearing three long ciliated setae (fig. 37, *c*). This obviously corresponds to the exopodite of the Euphausiacea and Penaeidea.* The endopodite is large and two-jointed. The exopodite is not present in the earliest known stage of *A. purpurea* (Kemp, 1907).

Second maxilla. There are four distinct basal lobes, a suture running across between the first and second pair, but the endopodite was not, in the specimen examined, distinctly marked off by a joint. On the other hand, there is a distinct joint between the basal lobe of the endopodite and the second lobe, giving the appearance of the existence of five lobes on the protopodite and a two-jointed endopodite. Actually, the endopodite appears, from a comparison with later stages, to be three-jointed. The exopodite is a small plate with five setae. The whole limb is distinctly more pediform than is usual in Caridea.

There are three pairs of maxillipedes and no trace of pereiopods. The maxillipedes have the endopodite four-jointed, and the exopodite of the first pair has four setae arranged asymmetrically, i. e. two apical and one sub-apical strong setae, and a short slender seta on the inner side at some distance from the end.

Stage II. Length, 3·55 mm. (fig. 37).

This stage differs but little from the first. There is a small dorsal knob at the posterior end of the carapace, and a large pterygostomial spine has appeared. The eyes are moveable, and a single pereiopod rudiment is present. The telson has a formula of 8 + 8. The mouth-parts are unchanged, the first maxilla having still an exopodite.

* In *Paratya compressa* Ishikawa (1885) figures a pair of ciliated setae on a papilla on the first maxilla. This is also a vestigial exopodite.

A larva of 6 mm. from station 106 (fig. 38) represents a slightly further advance on that mentioned above, since it has an additional pair of leg rudiments, but it no doubt belongs to a different species although it is practically identical in other respects. In this larva and also in those from stations 120 and 122 the first three abdominal somites do not appear to be movable on one another, and I have been unable to see any distinct suture between them.

Stage III. Of this stage there are no specimens in collections from stations 120 and 122, but I believe that a specimen from station 109 (fig. 39) belongs to the same species. This specimen measures about 5·15 mm. The general form is very slender.

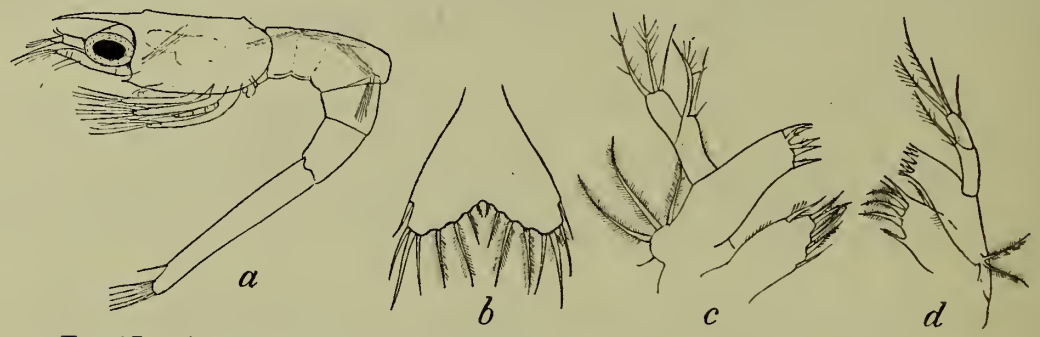

Fig. 37.—*Acanthephyra* (?), sp. Station 120. *a*. Stage II. *b*. Stage II. Telson. *c*. Stage I. First maxilla. *d*. Stage IV. First maxilla.

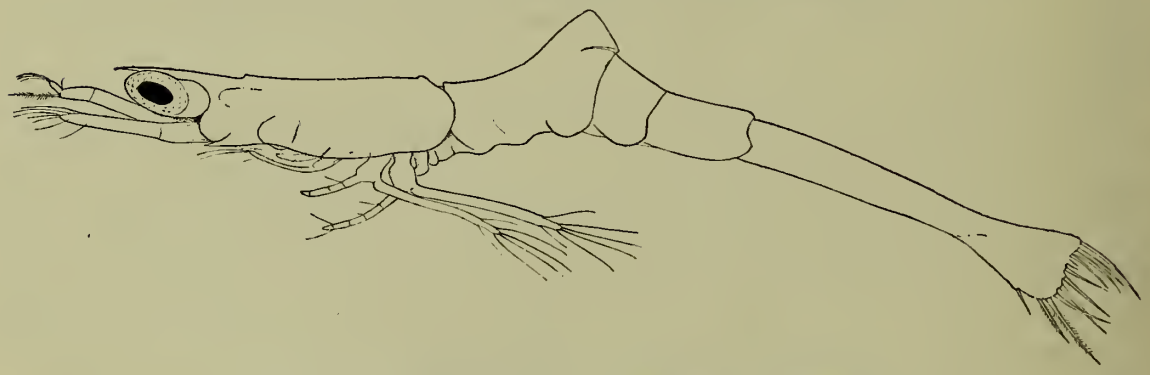

Fig. 38.—*Acanthephyra* (?), sp. Station 106. Stage II.

The third abdominal somite has grown out into a kind of hood over the fourth somite. The eyes are rather small, and are on very long stalks extending beyond the rostrum, which is relatively shorter than before. The first antenna has rudimentary exopodite and endopodite and a three-jointed stem. The antennal scale is still jointed, but the endopodite is reduced to a pointed rod. The maxillipedes have five-jointed endopodites, and there are two pairs of pereiopod rudiments. There is no sign of pleopods, but the uropods have appeared, the exopodite with six setae, but the endopodite quite rudimentary. The telson is narrow but deeply cleft and bears 8 + 8 setae.

A specimen from station 65 of 3·1 mm. is evidently the larva of a Hoplophorid in stage III. It has two pairs of rudimentary pereiopods, but no trace of pleopods; the uropods are present, shorter than the telson, and the endopodite has two setae.

I give a figure of the extremity of the first antenna of this specimen (fig. 40, *b*) since it shows very well the great development of the "antennular lobe." This

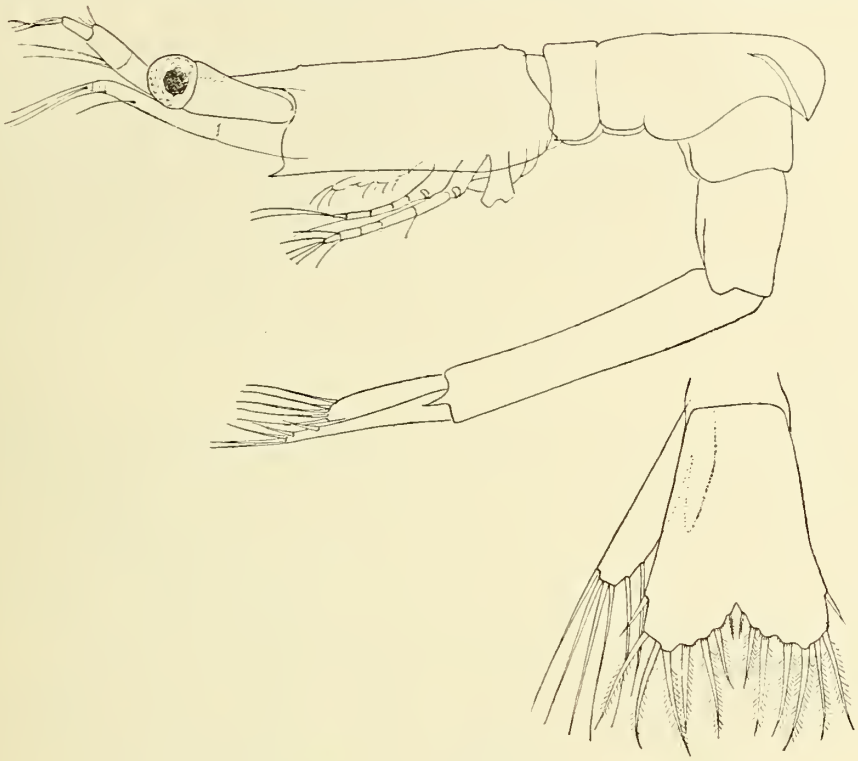

Fig. 39.—*Acanthephyra* (?), sp. Station 109. Stage III.

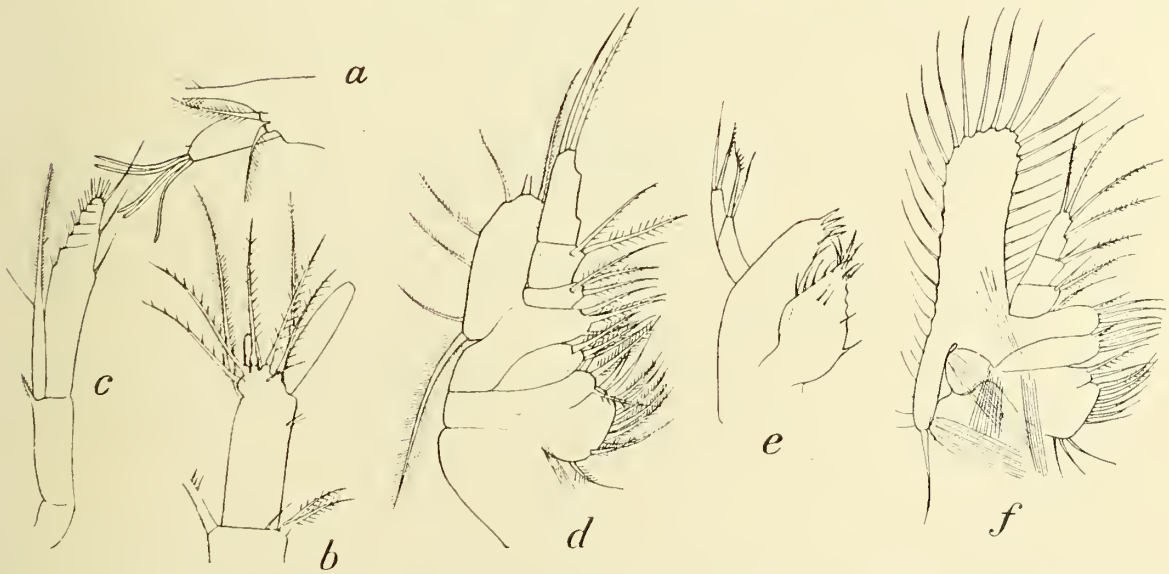

Fig. 40.—*Acanthephyra*. *a*. First antenna. Stage III. Station 106. *b*. First antenna. Stage III. Station 65. *c*. Second antenna. Stage III. Station 106. *d*. Second maxilla. Stage IV. Station 120. *e*. First maxilla. Station 129. *f*. Second maxilla. Station 129.

structure is particularly well developed in all the larvae examined, but in the earlier stage bears only two sensory setae (fig. 40, *a*) instead of five as shown here. This

lobe, which is traceable in almost all Caridea and in some other Decapods, is found also in Euphausiacea and Mysidacea and is evidently an inheritance from a primitive ancestral Caridoid form.

Stage IV. A fourth stage is represented by a specimen from station 120 of about 7·6 mm. Unfortunately this specimen is very decayed and damaged, but it appears still to have only the same number of appendages as in stage III, i. e. rudiments of two pairs of pereiopods. The mandible has no palp, and the first maxilla still retains a trace of the exopodite in the form of a minute papilla with two long and one very minute seta (fig. 37, *d*). The second maxilla has the endopodite distinctly three-jointed (fig. 40, *d*). The telson is narrower, with a formula of 8 + 8.

The uropods are much shorter than the telson, and the endopodite bears two terminal setae.

A specimen from station 109 of about 5·75 mm. is rather difficult to place, and probably belongs to another species, although almost identical in form. In this specimen the first four pereiopods are developed with functional exopodites, and leg 5 is a minute rod. The antennal scale is not jointed, but has a distal spine, and the endopodite is a short blunt rod about one-third the length of the scale. The eyes are shorter and less slender than in stage III, and the rostrum has a small dorsal spine. The endopodite of the uropods bears setae, and there are no pleopods.

A specimen from station 130, of 10 mm., which is much damaged, seems to represent a further stage of the species shown in fig. 38 (station 106). It is characterized by its very short eyes. There are no pleopods, but legs 1 and 2 are fully developed and there are rudiments of legs 3 to 5.

The telson is nearly parallel-sided, with two pairs of lateral spines and six pairs of terminal spines.

The interest of this imperfect series may be thus summarized :

1. Several species of Hoplophoridae have almost precisely the same form of larva.

2. The structure of the first maxilla affords additional evidence of the primitive status of the family.

3. Larval life is very prolonged.

There appear to be three stages corresponding to the first three stages universal among Caridea, but the appearance of the pereiopods is more gradual than usual, resulting in a greater number of stages following stage III.

Acanthephyra (*?*), sp.

At stations 86, 92, 129, and 131 Hoplophorid larvae were taken which differ from the series described above in having the posterior ventral margin of the carapace and the epimera of the first abdominal segment denticulate. According to Kemp the older stages of *A. purpurea* have the carapace denticulate, while in younger stages it is smooth, and it is therefore possible that these specimens really belong to the same series as those above described.

Specimen 1. Station 131. Length, about 8 mm. (fig. 41).
Eyes very long and slender. No mandible palp.
Legs 1 to 4 developed, leg 5 rudimentary.
Pleopods small. Uropods fully setose.
Telson narrow, parallel-sided, formula 8 + 8.

Specimen 2. Station 129. Length, 15·5 mm.
Eyes long, slender. All legs developed, with exopodites.
Endopodite of second antenna about half length of scale.
Rostrum short, with dorsal spine.

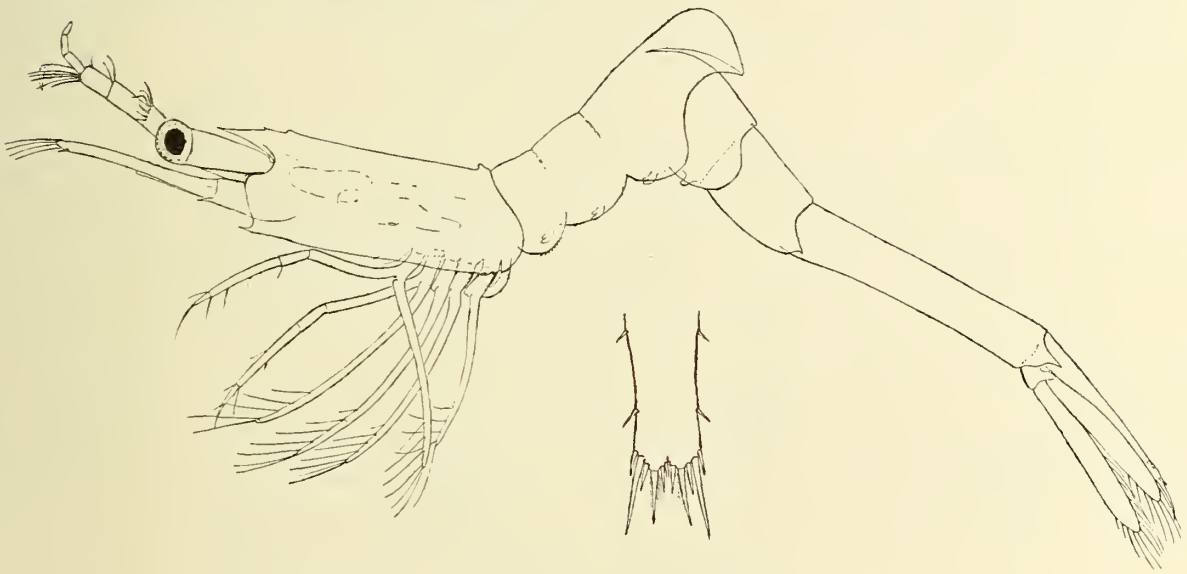

Fig. 41.—*Acanthephyra* (?), sp. Station 131.

Pleopods present, the first and fifth the smallest.
Mandible with minute rudiment of palp.
First maxilla without exopodite (fig. 40, *e*).

Specimen 3. Station 86. Length, 12 mm.
All legs developed, with exopodites. Rostrum with three small teeth.
Mandible with rudiment of palp.

III. Pasiphaeidae.

Very little is known of the development of the Pasiphaeidae. In some cases, as in *Parapasiphaë sulcatifrons*, the eggs are of great size and development consequently abbreviated, which is rather an exceptional feature for a pelagic or bathy-pelagic species. The larva of *P. sulcatifrons*, which has been described by Kemp (1910), hatches in a very advanced condition and, as is usual in such cases, the uropods appear later than the pleopods. In *Pasiphaea tarda* also (Björck, 1911) the eggs are large and the young hatch with all the appendages except the uropods. How far such a shortened development is general it is impossible to say, since it

is unusual for the size of the egg to be given by those who describe species, but in some cases the eggs are small and numerous (*Leptochela robusta*, DeMan, 1920) and larvae which may reasonably be attributed to Pasiphaeidae have been described. Coutière (1907) has attributed to this family larvae of the type described by Ortmann under the name of Anisocaris. These larvae are generally characterized by the smooth, straight rostrum, the possession of an exopodite of the fifth leg, and strongly flexed abdomen without spines but with a large protuberance on the third somite. There is no mandible palp.

I have not found in the "Terra Nova" collections any early larvae which can be assigned to this family. On the other hand, I think that a sub-adult form taken at station 93 should be mentioned and figured (fig. 42).

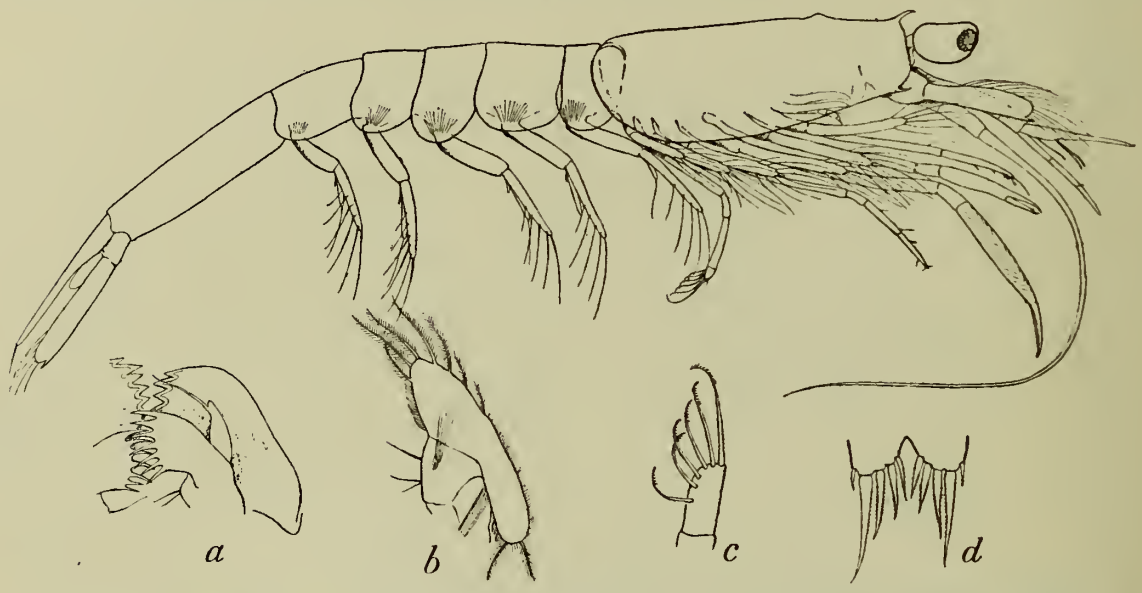

FIG. 42.—*Pasiphaea* (?), sp. Station 93. *a*. Mandibles and first maxilla. *b*. Second maxilla. *c*. Endopodite of fifth leg. *d*. Telson.

In this collection two specimens, each of about 6 mm., were taken which, although no doubt immature, have all the appendages of adult form. A detailed description is superfluous, but the following points should be mentioned.

1. The mandible has no palp. Having regard to the degree of development of the other appendages I do not think the absence of the palp is due solely to immaturity.

2. The second maxilla has no trace of enditic lobes.

3. The endopodite of the first maxillipede is absent.

4. The exopodite of the second maxilla is reduced, and without setae.

5. The fourth leg is scarcely longer than its exopodite and considerably shorter than the fifth.

These characters taken together undoubtedly place this animal within the genus *Pasiphaea*, but I am unable to find any species with which it agrees. In one respect

it seems to be unique, namely in the very peculiar form of the eyes. These are of fair size, but they have no retinal pigment, and the ommatidia are arranged apparently in a small flat disk at the end of the eye-stalk.

IV. Pandalidae.

The development of the European species of *Pandalus* and *Pandalina* has been fully described by Sars (1899), but it is by no means certain that these species can be taken as typical of the whole of this large family. Coutière (1907, p. 20) has attributed to the Pandalidae the larvae described under the names of Icotopus, Kyptocaris, and Oligocaris, and has himself described an additional genus, Pandacaricyphus.* He also suggests that the genera Eretmocaris and Atlantocaris may belong here.

The larvae of Pandalidae, Processidae, and some Hippolytidae (*Spirontocaris*) are very much alike, and the information available is quite insufficient for their satisfactory separation. Confusion is also possible between the Pandalidae and Hoplophoridae in early stages before the last pereiopod is developed, since in some cases which seem to be referable to the Pandalidae there is a distinct prominence of the third abdominal somite as in *Acanthephyra* (see p. 115).

I am not aware of any species of Pandalidae (or Thalassocaridae) with large eggs and abbreviated metamorphosis, so that the larvae should be abundant in the plankton. I have found larvae which I attribute to this family in collections from seventeen stations, but in most cases they have no special interest. The following are, however, worth noticing.

Pandalidae, species 1 (fig. 43). Stations 132, 133, 136.

Though quite a large number of specimens of this species have been found, they nearly all belong to the first stage, and there are no specimens sufficiently advanced to give a clue to the adult characters. The species is remarkable for having the ventral margin of the carapace armed with a row of teeth, and the third, fourth, and fifth abdominal somites have also a fringe of teeth, which give a striking appearance to the larva.

The rostrum is very long, and armed with spines at the end. The telson is very large and triangular, rather resembling that of a Palaemonid. The third maxillipede has the endopodite of unusual length and size, reaching forwards beyond the eyes. The second antenna has a jointed scale, and the endopodite is slender and continued into a long spiniform seta with a short seta at the origin of it.

The first maxilla is quite normal without trace of exopodite or outer setae, and with a one-jointed endopodite.

The second maxilla has four inner lobes and a broad one-jointed endopodite. The exopodite bears five setae and has no proximal prolongation.

* Coutière's *P. pandaliformis* has an exopodite on the fifth leg. It seems more likely that it belongs really to the Hoplophoridae.

The first stage measures about 4 mm. The second stage, which is about 5·3 mm., differs from the first in the following respects :

1. There is a pair of supra-orbital spines, a knob behind the rostrum, and another at the posterior end of the carapace.

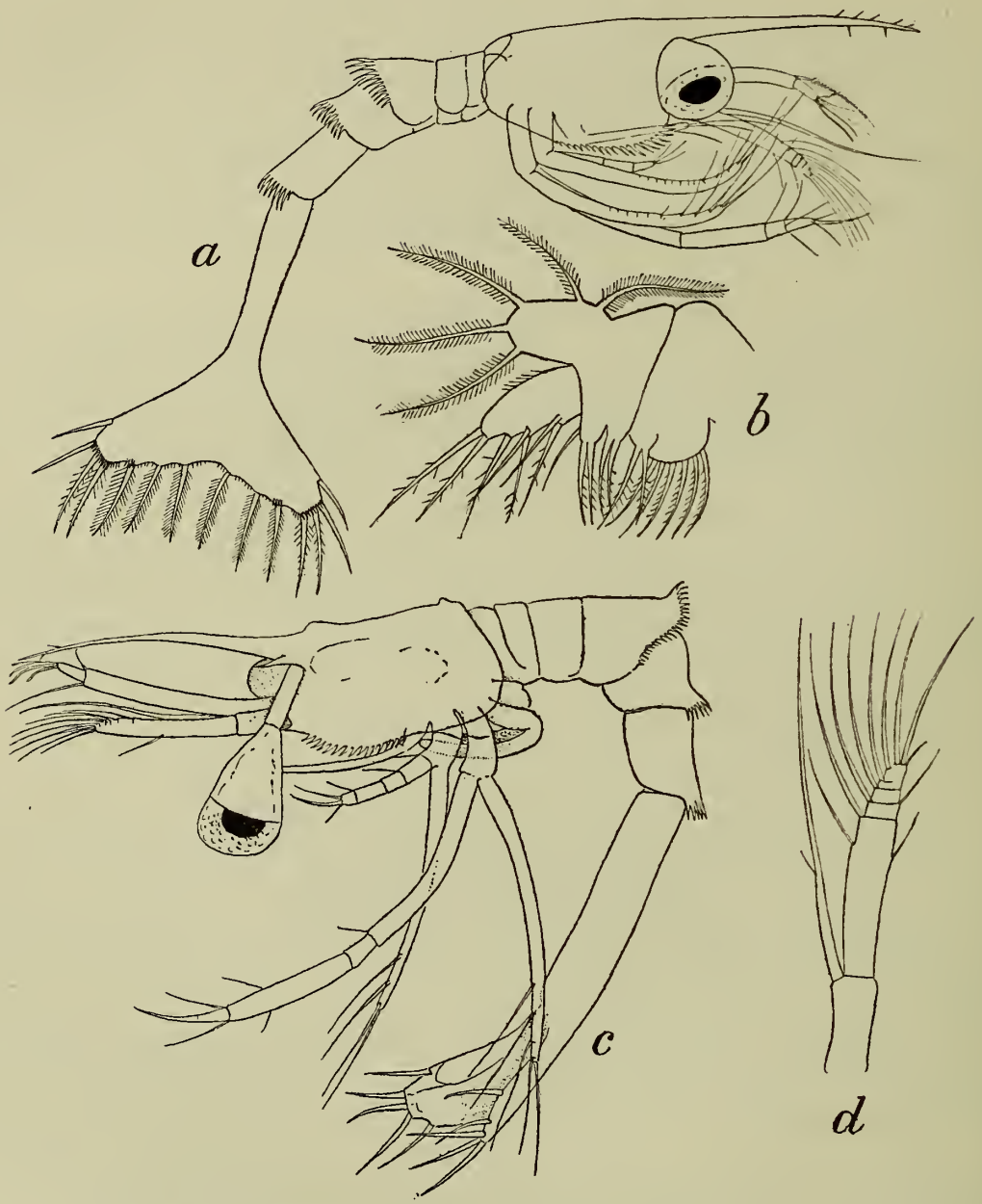

Fig. 43.—Pandalidae. Species 1. *a*. Stage I. *b*. Second maxilla. Stage I. *c*. Stage II. *d*. Second antenna. Stage I.

2. The eyes are seated on long slender stalks (fig. 43, *c*).
3. There are rudiments of two pairs of legs.
4. The uropods are visible beneath the skin.

This larva seems to provide a means of transition between the normal Pandalid

type and the "Eretmocaris" type of larva with its enormously elongated ocular peduncles; in fact it is possible that it is actually itself an early stage of an "Eretmocaris." At the same time, as I shall show below, some "Eretmocaris" larvae do not belong to the Pandalidae.

Pandalidae, species 2 (fig. 44).

A rich plankton collection from Melbourne harbour contained several specimens

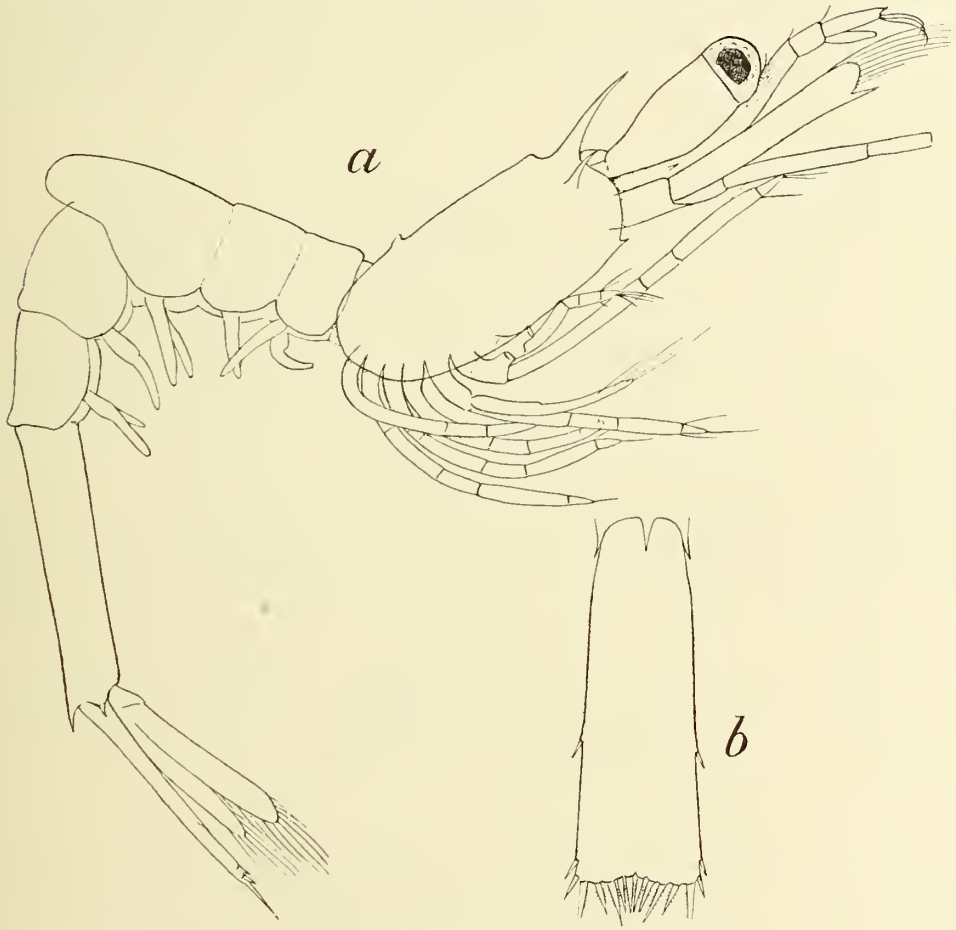

Fig. 44.—Pandalidae. Species 2. *b*. Telson.

of a larva which I attribute with some doubt to a genus of Pandalidae. Four stages are represented, the youngest measuring 4·25 mm. and having only one pair of legs developed, the remainder being visible as small buds. The pleopods are just traceable, but the uropods are present. It is therefore in stage III.

The next stage differs but little, having still only one pair of biramous legs, but this stage is marked by the prolongation of the third abdominal somite into a distinct posterior hump and the appearance of the pleopods.

The oldest larva (5·5 mm.) is shown in fig. 44, and has all the legs developed, the second pair having a rudimentary chela. It will be seen that this larva has

a marked resemblance to that of a Hoplophorid, but it differs in having no trace of mandible palp, in the one-jointed endopodite of the first maxilla, and especially in having no exopodites on the last four legs. In the form of eye, the long slender first antenna, the large supra-orbital spine, and the order of appearance of the legs this larva agrees best with the Pandalidae (*Pandalus*), but the small toothless rostrum, the humped third abdominal somite, and the absence of exopodites from the last four legs are characters which weigh against such an identification and suggest the possibility that it may belong to the Hippolytidae. In *Pandalus* the first three or four legs bear exopodites, but in *Hippolyte* they are absent from the last three pairs. No species is known in either family in which they are absent from the last four.

Pandalidae, species 3 (*Icotopus arcurostris*, Bate). Station 93 (fig. 45).

The larval genus Icotopus was founded by Bate on an early Mysis stage taken off Cape Howe, Australia, and Coutière has described two very similar larvae from the Atlantic, one of which represents an older stage than Bate's specimen. I have had the opportunity of examining a series of larvae from 5 mm. up to about 20 mm. and representing six stages in development. They seem satisfactorily to establish Coutière's reference of Icotopus to the Pandalidae.

Stage IV (youngest stage observed). Length, 5–6 mm. (fig. 45, *a–c*).

The rostrum, which is at this stage shorter than the eyes, may either have no teeth at all, or may have one to three very small dorsal teeth. The supra-ocular spines are very small.

The ventral margin of the carapace terminates in a large pterygostomial spine, behind which follow one to three teeth. The eyes are very long, on slender peduncles, and the first antenna is long and slender, with rudimentary branches.

The scale of the second antenna has a terminal spine, and the endopodite is very short and pointed (fig. 45, *c*).

Legs 1 and 2 are biramous and functional, while legs 3 to 5 are rudiments. The endopodite of the third maxillipede is very long. Pleopods are absent, but uropods are developed, with setae on the endopodite. The telson scarcely widens distally, is deeply hollowed, with a formula of 8 + 8 (fig. 45, *b*).

Stage V. Length, 8 mm.

There are now seven dorsal spines in front of the "dorsal organ," four of which are post-orbital. The rostrum extends beyond the eyes.

Legs 1 to 4 are fully developed, but the fifth is still a small rudiment. There are no pleopods.

Stage VI. Length, 10 mm.

Rostral teeth, 11/5. Eyes rather shorter than before.

All legs fully developed.

Pleopods as small buds.

Stage VII. Length, 11–13 mm. Mysis stage I.

Rostral teeth, 10–12/5–6.

About six spines on ventral edge of carapace.

All legs fully developed, with exopodites on legs 1 to 4. Pleopods large.

Stage VIII. Length, 14 mm. Mysis stage II.

(Rostrum broken.)

This stage differs from the preceding only in the great narrowing of the telson, which has three pairs of lateral and six terminal spines, and in the structure of the second leg, which is sub-chelate.

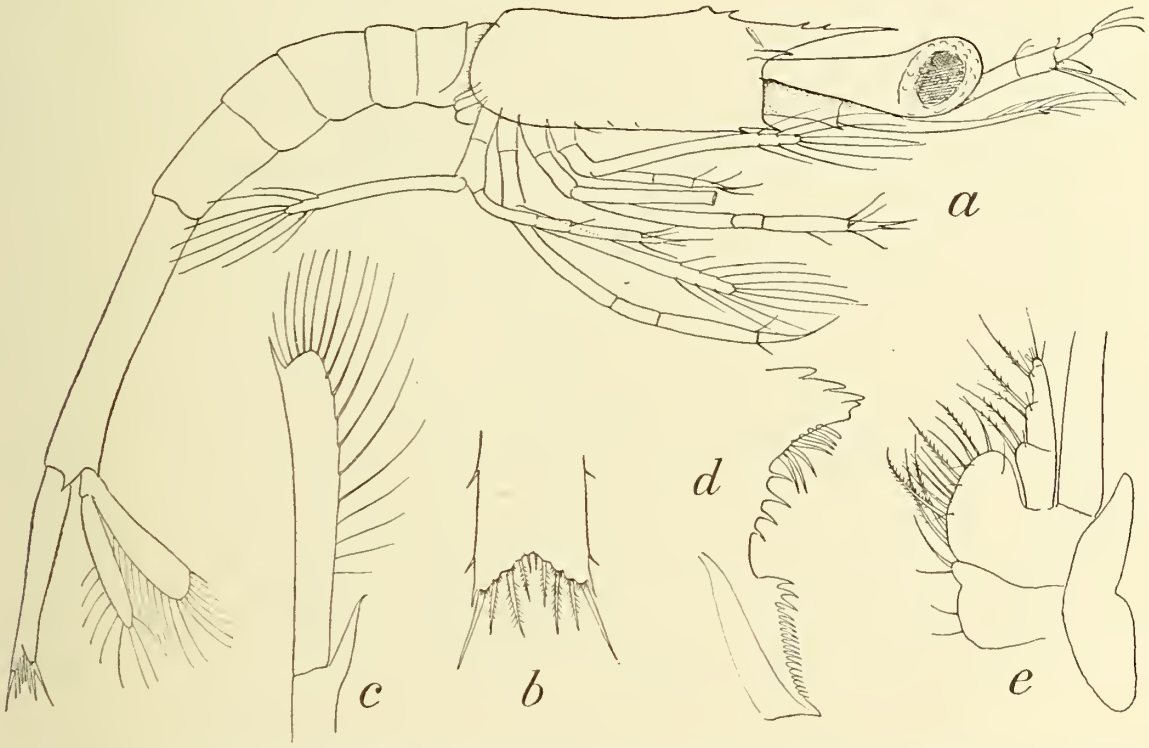

Fig. 45.—Pandalidae (Icotopus). Station 93. *a*. Stage IV. *b*. Telson. Stage IV. *c*. Second antenna. Stage IV. *d*. Mandible of last larva. *e*. First maxillipede of last larva.

Stage IX. Length, 20 mm. Mysis stage III (figs. 45, *d*, *e*, 46).

This is evidently the last larval stage. The eyes are very much shortened, and the rostrum of great length. In the specimen figured the rostrum is down-curved, but this is probably accidental.

The antennae approximate to the adult form, the flagellum of the second pair being very long and slender.

The mandible has no palp and is not cleft (fig. 45, *d*).

First maxilla of usual form, with one-jointed palp.

Second maxilla with four inner lobes, the endopodite one-jointed.

First maxillipede with the coxopodite lobe small, basipodite lobe very large and produced distally. Endopodite four-jointed (fig. 45, *e*).

Second maxillipede five-jointed, the terminal joint not modified. There is a large bi-lobed epipodite.

Third maxillipede of four joints, the ischium and merus fused. Carpus short, propodus long.

Leg 1 shows no trace of a chela.

Leg 2 is chelate, but the chela imperfectly formed.

Pleopods large, biramous, with appendix interna but no setae.

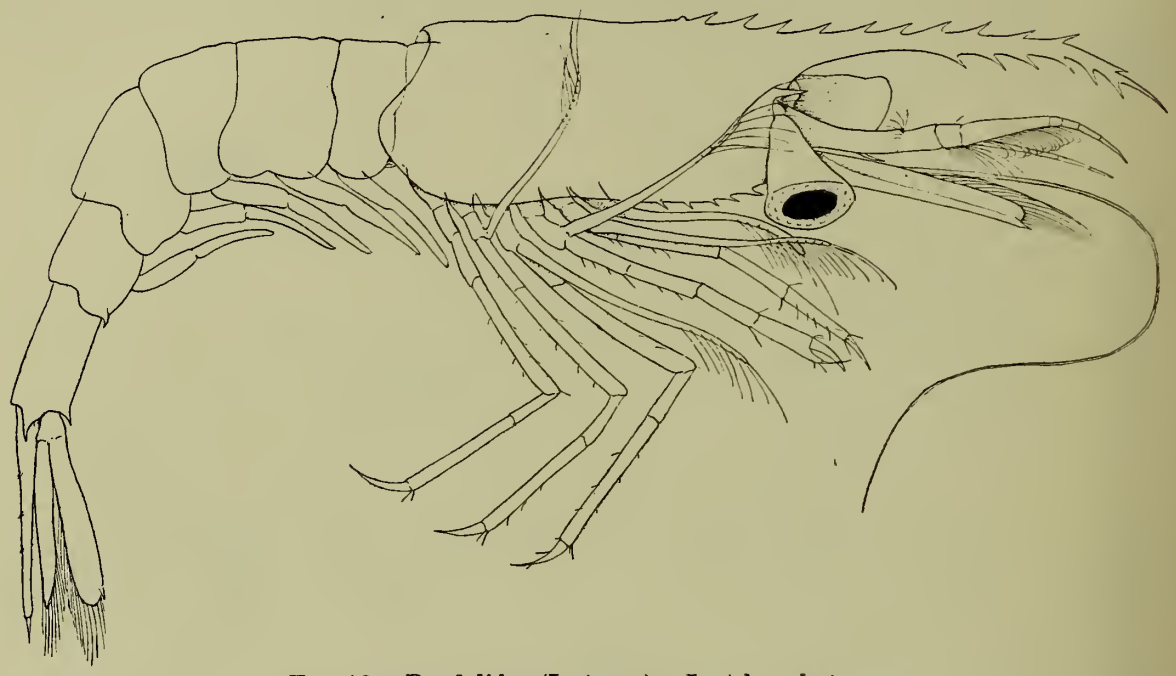

Fig. 46.—Pandalidae (Icotopus). Last larval stage.

Gill formula:

	Mxp. 1	Mxp. 2	Mxp. 3	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5
Podobranchs	Ep.	1+Ep.	Ep.	Ep.	Ep.	Ep.	Ep.	—
Arthrobranchs	—	—	2	1	1	1	1	—
Pleurobranchs	—	—	—	1	1	1	1	1

V. Alpheidae.

The development of the Alpheidae has been fully described by Brooks and Herrick (1891) for *Alpheus*, and by Sars (1906) for *Athanas*, while unidentified larvae have been figured by Bate and others under the generic names of Anebocaris and Diaphoropus. It appears to be characteristic of the family that the larvae have a small, untoothed rostrum, and that the fifth leg develops precociously into an enormously long styliform appendage.

Alpheid larvae are very common in the "Terra Nova" collections from a number of stations, but none can be identified, and they add nothing to our knowledge. A larva probably belonging to the genus *Athanas* is figured on p. 127 (fig. 51, *h*) for comparison with the larvae of Pontoniinae.

At station 46 a single specimen was taken of the remarkable Alpheid larva described by Coutière (1907) under the name of *Anebocaris ancylifer*. I have nothing to add to his description.

VI. Hippolytidae.

The only species of which the development is known with certainty are *Hippolyte varians* (Sars, 1912) and *Lysmata seticaudata* (Caroli, 1918), but there is no reason to doubt the correctness of Stephensen's reference of certain larvae to the genus *Spirontocaris* (1912, 1916). Kemp has also identified the larva of *Tozeuma* (1916).

Whereas in every other family of Decapods, so far as information goes, the larvae are of one type and generally show no great dissimilarity, the Hippolytidae stand altogether apart, for each of the larvae mentioned differs so much from the other three that it is difficult to believe that they are members of a single family. The larva of *Spirontocaris* is scarcely distinguishable from that of *Pandalus*, while that of *Lysmata* has the long, slender endopodites of *Spirontocaris* but resembles the Palaemonidae and Alpheidae in the order of the appearance of the legs and the great size of the fifth pair. *Tozeuma*, so far as it is known, is not unlike *Hippolyte* in essential features.

The species known are obviously too few in proportion to the whole to allow of any systematic deductions to be made, but the necessity for extending our knowledge of these larvae seems to be emphasized.

I have met with a few larvae in the collections which may with some doubt be referred to the Hippolytidae, but there is too much uncertainty in their identification to make their description profitable. I have, however, referred to this family the larvae of Bate's genus "Eretmocaris," which should be mentioned here.

Lysmata? (Eretmocaris, Bate.)

Larvae of the larval genus Eretmocaris were taken only at stations 40 and 43, and these are in early stages and badly damaged.

One of these larvae (length, 4·7 mm.) is in stage IV, having well-developed uropods but no trace of pleopods, and has certain features of interest.

1. It is usual at this stage in Caridea for the flagella of the antennae to be rudimentary, but in this specimen the first antenna, the peduncle of which is very long and extends beyond the long-stalked eyes, bears two branches, each of three slender joints, of which the inner is about two-thirds of the length of the peduncle.

The flagellum of the second antenna is broken off, but the broken stem indicates a greater length than is usual.

2. All the functional legs are broken off, but while legs 1, 2, and 5 were evidently fully developed, legs 3 and 4 are still quite rudimentary.

So far as I know, the only description of "Eretmocaris" is that of Bate, whose specimens were all in the Mysis stage and were much damaged, and it seems to me that the "Terra Nova" larva provides the evidence necessary to refer the genus to its adult family.

The only larva approaching Eretmocaris in form is that described by Chun (1888) as *Miersia clavigera* * and finally identified by Caroli (1918) as the larva of *Lysmata seticautada*. This larva has the peculiarity that leg 5 is developed precociously in stage II, and is of enormous size when legs 3 and 4 are still rudimentary. Exactly the same thing is found in the larva now in question, which is undoubtedly an "Eretmocaris," whereas such an order of appearance is quite unknown among the Pandalidae to which larvae of this type have been referred.

For this reason I consider "Eretmocaris" to be the larval stage of *Lysmata* or of an allied genus.

The great paddle-shaped enlargement of the propodite of the fifth leg in *Miersia clavigera* recalls the similar enlargement in legs 1 and 2 of *Pandalus borealis*, but does not indicate any relationship.

VII. Palaemonidae.

The most complete account of the development of a Palaemonid is that of Mortensen (1897) for *Leander fabricii*, but Sollaud has quite recently (1923) given a very full description of the larvae of *L. serratus*, *Palaemonetes varians*, and a number of other species in which the development is more or less abbreviated. In addition, larvae evidently belonging to the family but which could not be referred to adults have been described by Bate and Ortmann under the larval genera Retrocaris and Mesocaris.† The larva to which Bate (1888, p. 665, footnote) gave the name *Odontolophus serratus*, was certainly that of a species of *Leander*.

Unfortunately, nothing is known about the development of any species of Pontoniinae.‡

Within the genus *Leander*, the larvae of the four European species of which the development is known are so alike that they are difficult, or even impossible, to separate, while that of *Palaemonetes varians microgenitor* (*P. occidentalis*, Sollaud) is built on precisely the same plan.

Quite similar larvae were taken by the "Terra Nova" in Melbourne harbour, and these may be referred without doubt to *Leander* or *Palaemonetes*, but the identity of the remaining larvae, which fall within the genera Retrocaris or Mesocaris, is doubtful.

* Excellent figures of this larva are given by Brooks and Herrick (1891), Pls. IX, X, as the larva of *Stenopus hispidus*.

† *Coronocaris*, Ortmann probably does not belong to the Palaemonidae although so referred by Coutière.

‡ Gourret (1884) described the first larva of *Pontonia* in a very unsatisfactory way.

It is well known that, within the Palaemoninae, the species inhabiting fresh or slightly brackish water tend to have development more or less abbreviated, and Sollaud has given a number of instances showing progressive stages in this abbreviation in the genus *Palaemon*. But, although this genus is characteristic of fresh water, there is no doubt that some of the species have a complete metamorphosis which is probably carried out in the sea. This is certainly the case in *P. jamaicensis*, in which the eggs measure about 0·65 by 0·5 mm.* and the young on hatching have the characters of a normal Zoea. Similarly *P. olfersi*, according to Aurivillius (1898), hatches as a normal Zoea, and it is noteworthy that both these species occur on both sides of the Atlantic and may owe their wide distribution to having preserved a complete metamorphosis. On the other hand it is difficult to believe it possible for the whole width of the Atlantic to be crossed within the period of metamorphosis, especially having regard to the present direction of surface currents.

There is no doubt then that the larvae of the genus *Palaemon*, in addition to those of the marine genera of Palaemoninae and Pontoniinae, are to be looked for in the sea, and I suggest that the large forms of Retrocaris may belong to *Palaemon*. Sollaud has suggested that all these problematical larvae may belong to the Pontoniinae, but all the Pontoniinae are comparatively small, most of them very small, and it is hardly possible that these larvae could reach the sizes attained by Retrocaris.

For these reasons I have assigned the Palaemonid larvae met with provisionally to *Leander*, *Palaemon*, and Pontoniinae.

Palaemoninae.

1. *Leander* (figs. 47 and 48).

A considerable number of specimens of *Leander* larvae belonging to two species were taken in Melbourne harbour. The two species are quite easily distinguished, but in both the resemblance to the larvae of European species such as *L. serratus* is most striking. The earliest stages are not represented, but there are examples of stages III, IV, and V which agree precisely with those of *L. serratus*.

Species I.

Stage III. Length, 3·7 mm.

This larva exactly resembles the corresponding stage of *L. serratus* with the exception that there is only a single median dorsal spine on the carapace.

Legs 1 and 2 are functional, but without trace of chelae.

Legs 3 to 5 are rudimentary, leg 5 being the largest.

Four pairs of pleurobranchs present.

The telson is of the usual form with a formula of 8 + 8, and the uropods have the inner branch without setae.

* From specimens in the British Museum.

Stage IV. Length, 4·35–4·55 mm.

An additional toothed dorsal spine has appeared.

All the pereiopods are developed with the exception of the fourth which is still a biramous rudiment, while the fifth pair is exceedingly long. Legs 1 and 2 are sub-chelate.

Five pairs of pleurobranchs present.

The pleopods appear as small buds, and the endopodite of the uropods bears setae.

The telson is parallel-sided, with two pairs of lateral and five pairs of terminal spines.

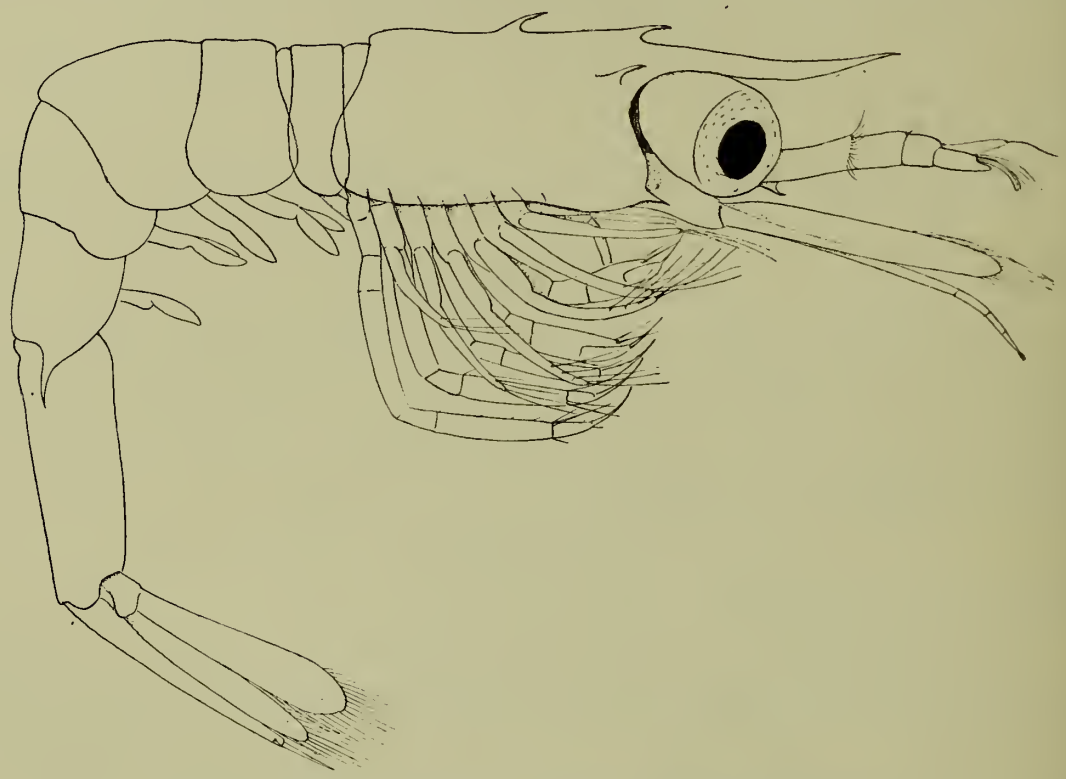

Fig. 47.—*Leander*. Species I. Stage V. Melbourne Harbour.

Just as is the case in *P. varians* (Gurney, 1924) there is some variation in this stage with regard to the degree of development of the pleopods and chelae, but there do not seem to be more than two definite stages, IV and V, corresponding to two moults.

Stage V. Length, 6–6·9 mm. (fig. 47).

This stage differs from the preceding in the large size of the pleopods, which have traces of the appendix interna, the development of the fourth legs, and the enlargement of the chelae of legs 1 and 2. The flagellum of the second antenna is also longer than the scale, and partly jointed. The telson is long and narrow, but with spines as before.

Species II (fig. 48).

This species is distinguished from the first in the fourth and fifth stages, which alone are present, by having three dorsal spines instead of two. In other respects there is no difference, and it would be exceedingly difficult to separate them from the larvae of any European species. Larvae in stage IV measure about 5·75 mm., but there are two individuals both referable to stage V of 6·6 mm. and 11 mm. respectively. I have no reason to doubt that they both belong to the same species, but if so it is clear that the last stage may persist for some time and include a number of moults as is apparently the case in Retrocaris.

The specimen of 11 mm. is approaching the moult to the post-larval condition, and it is possible to recognize under the cuticle of the rostrum four dorsal and two ventral spines (fig. 48). It is clear, also, that the three dorsal spines of the larva

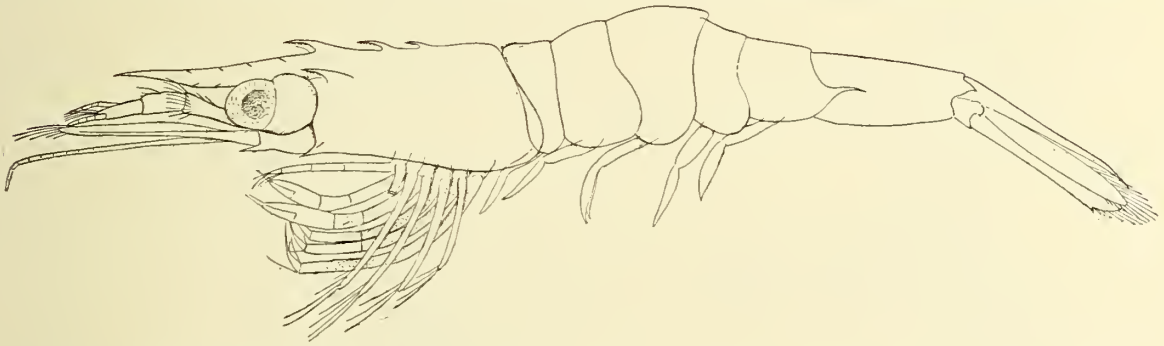

Fig. 48.—*Leander.* Stage V. Melbourne Harbour. The exopodites of this specimen were broken off. They have been drawn in rather too long.

would be preserved in the post-larval stage. In *P. varians* two of the three spines are lost at the moult, but in *L. serratus*, according to Sollaud (1923, p. 598), all three are lost.

Palaemon, sp.? (Retrocaris) (fig. 49).

At stations 46 and 49 six specimens of a remarkable Palaemonid larva were taken which closely resemble *Retrocaris contraria*, Ortmann. One of these specimens measures 9·5 mm., but the remainder are from 13·5 to 19 mm. in length, the largest therefore considerably exceeding Ortmann's type (16 mm.). They are not only exceptional in size, but remarkable in structure. I have not dissected the smallest specimen, but, so far as can be seen, it differs so little from the others that the same description applies to all.

They are stout, heavily built animals with strong integument. The rostrum is long, sloping slightly upwards, with five to seven dorsal and three ventral teeth, only the hindmost of which is serrated. In addition there are two serrated spines on the carapace and a small blunt knob (dorsal organ?) immediately behind them. There is a long, straight supra-orbital, a pterygostomial, and a large hepatic spine, all smooth. A deep groove runs across the carapace behind the posterior spine and forwards on

either side to the supra-orbital, and there may be another transverse groove in front of the first post-orbital spine.

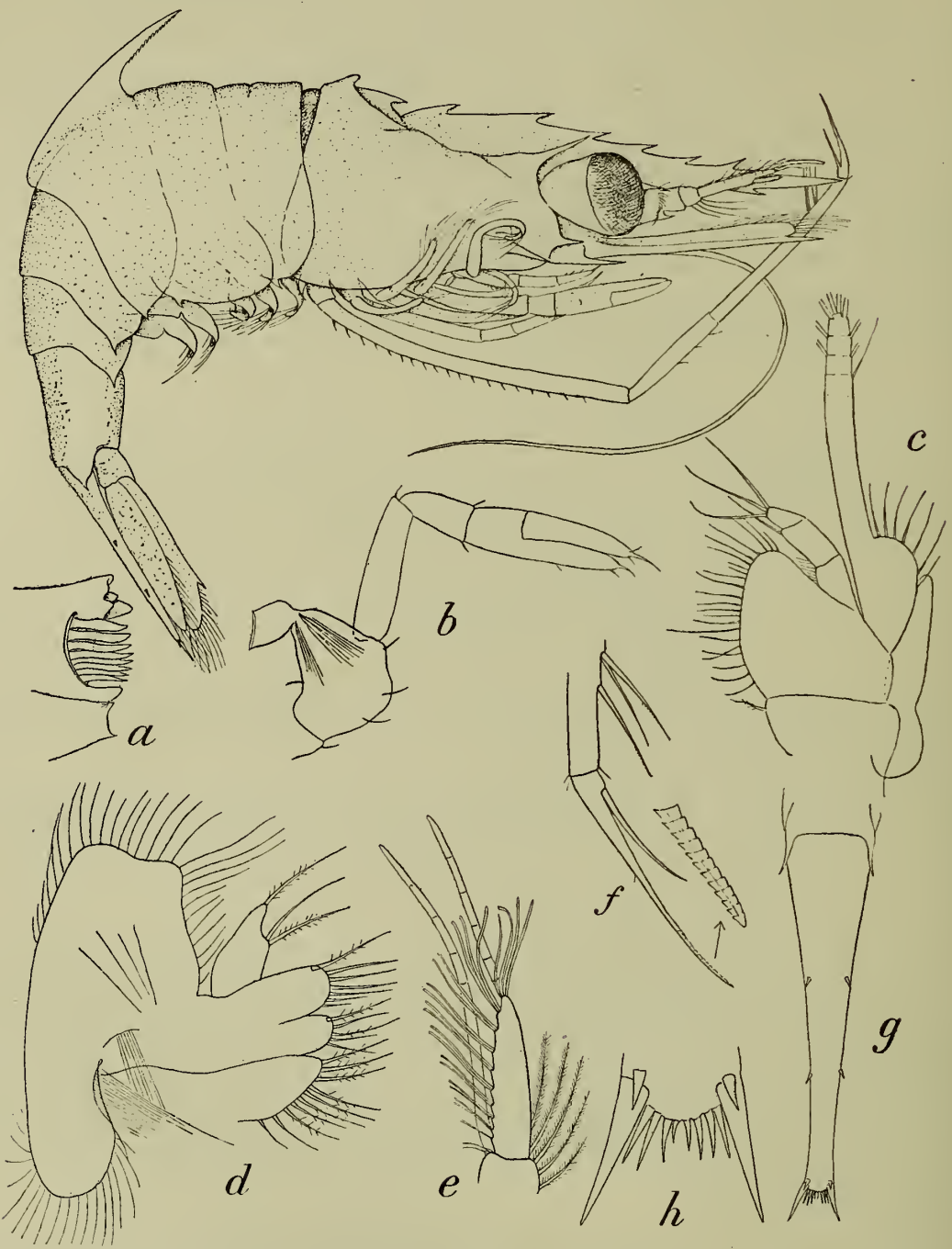

Fig. 49.—*Palaemon* (?) (Retrocaris). Station 46. *a*. Edge of mandible. *b*. First leg. *c*. First maxillipede. *d*. Second maxilla. *e*. End of first antenna. *f*. End of fifth leg. *g*. Telson. *h*. End of telson.

The abdominal pleura are very large. The first has a small median point, and the second a smaller one near its posterior edge, while those of somites 4 and 5 are

produced backwards into sharp points. The third somite is keeled, with a large, forwardly directed spine toothed on its lower edge.

The telson is long and exceedingly narrow towards the end, with two pairs of lateral and six pairs of terminal spines of which the second is greatly the largest (fig. 49, *g*, *h*).

The first antenna approaches the adult form. The otocyst is not formed but is represented by an open pit, the stylocerite being a simple pointed process without membranous overlap. The dorsal side of the first joint is hollowed, but does not widen out distally. There is a strong spine at the outer distal angle. The outer branch consists of a thick unjointed basal part bearing many aesthetes, and a slender terminal part, but no accessory branch (fig. 49, *e*). In the largest specimen there are traces of joints in the proximal part and an incipient accessory flagellum. This appendage is therefore much more advanced than it is in the last larva in *Leander*.

The scale of the second antenna has a large terminal spine, and the flagellum is slender, jointed, and of great length. In *Leander* it does not much exceed the scale.

The mouth-parts are of the usual larval form. The mandible has no palp, and is undivided (fig. 49, *a*).

The second maxilla has three well-developed lobes and a small one-jointed endopodite. The exopodite is very large and broad distally (fig. 49, *d*).

The first maxillipede has the basal lobe scarcely distinct and with one seta only, while the distal lobe is very large and produced distally. The endopodite has three joints, and the exopodite is expanded at its base and bears a number of setae. The epipodite is bi-lobed (fig. 49, *c*).

The second maxillipede is of larval form, with a large epipodite and a minute lobe which may represent the podobranch.

The third maxillipede has two very small papillae at its base which possibly are the rudimentary arthro- and pleurobranch.

Legs 1 to 4 have short exopodites. Legs 1 and 2 have large chelae and are of nearly the same size. Whereas legs 1 to 4 are relatively small, inconspicuous appendages leg 5 is enormous, flexed at the mero-carpal joint, and reaching forwards beyond the eyes. The dactylus has a stiff seta at its base and is prolonged into a peculiar spine with transverse ridges (fig. 49, *f*). The pleopods are almost hidden by the large epimera, but are fringed with setae and apparently functional.

Coutière has discussed at some length the problem of larvae such as this which attain sizes quite unusual as compared with the species of which we know the development, and concludes that they are abnormal and not destined to be transformed into normal adults (1907, p. 60). Bouvier arrived at the same conclusion with regard to *Glaucothoë* (see p. 185). It is indeed difficult to account for some of the extreme forms such as Ortmann's *Atlantocaris gigas*, which reaches 53 mm., but in view of the prolonged larval and "semi-larval" development of some Hoplophoridae and Penaeidae (*Funchalia*), it seems to me that we are not justified, on the

information available, in postulating abnormality as an explanation and formulating hypotheses to account for it. Our knowledge of Decapod development is wholly inadequate, and of the deep-water forms we know practically nothing. Still, such knowledge as we have does not support Coutière's view, for instances are known of larvae of established parentage which reach sizes as great as those he discusses. For example:

Pontophilus spinosus	16 mm.
Stenopus spinosus	30 mm. (Cano)
Tozeuma armatum *	31 mm. (Kemp, 1916, p. 400).

Fig. 50.—*Palaemon* (?) (Retrocaris). Stage III. Station 43.

In the particular case before us we have specimens of similar structure, taken in the same haul, of 10 mm.—which is quite a normal size for a *Leander* larva—and of 19 mm., and I see no reason why the latter should be assumed to be in any way abnormal. It does not fit in exactly with our knowledge of *Leander* development, but it is not for that reason to be considered abnormal. At the same time a larva of 19 mm. must develop into an adult of some size, and the whole of the Pontoniinae seem to be excluded for this reason alone. Also I have described below certain larvae which I believe do belong to Pontoniids and these are of quite different structure. On the other hand we know that some species of *Palaemon* have free larvae, and some of the adults are of very large size (e.g. *P. carcinus*), and it seems extremely likely that the larvae of the genus Retrocaris may belong to *Palaemon*.

* Coutière's *Caricyphus acutus* (19 mm.) is probably also a *Tozeuma* (1905, p. 21).

Three very small specimens of Retrocaris larvae were taken at station 43 (fig. 50). These measure about 2·8 mm. and are all in stage III, having legs 1 and 2 developed and 3 to 5 rudimentary, while the endopodite of the uropods has no setae.

The close resemblance to the large forms just described is very striking. Dorsally the carapace bears two median spines followed by a small blunt knob at the hind end. There is also a transverse furrow running from behind the anterior knob to the supra-ocular spine. The two dorsal spines are serrated, but the supra-ocular is smooth. There is a pterygostomial but no hepatic spine. In the arrangement of the

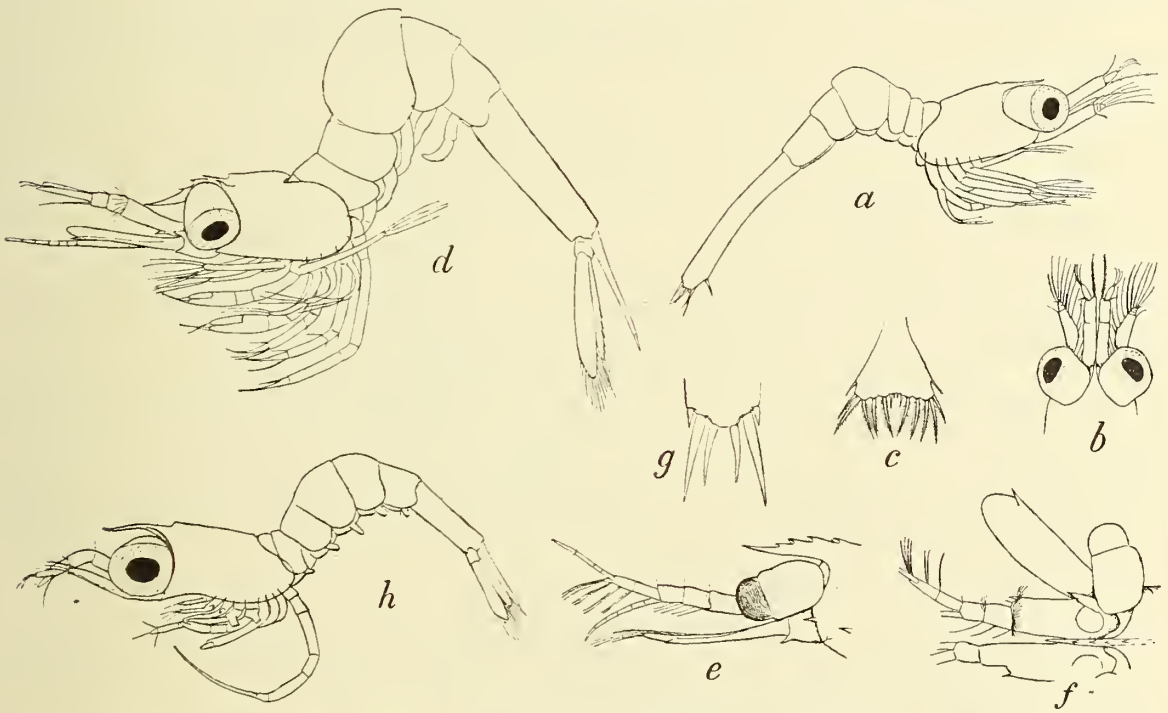

Fig. 51.—Pontoniinae. Species I. Station 40. *a*. Stage II. *b*. Stage II. Dorsal view of head. *c*. Stage II. Telson. *d*. Stage V. *e*, *f*. First post-larval stage. *g*. First post-larval telson. *h*. *Athanas* (?), Alpheidae. Stage IV. Station 40.

dorsal spines the agreement is exact, but I do not think this larva actually belongs to the same species as the large form, not only by reason of its small size, but also from its having a pair of lateral spines on the fifth abdominal somite. At all events it represents a closely allied species, and is not unlike Coutière's *R. antarcticus* which measures 5–6 mm. in its last stage.

Pontoniinae. Species I (fig. 51).

Station 40.

At this station a series of larvae were taken together with one post-larval specimen which almost certainly belongs to the same species and enables the larvae to be referred to the Pontoniinae with some confidence.

Stage II. Length, 2·14 mm. (fig. 51, *a*, *b*, *c*).

The body of the larva is much bent at the third somite, which is very large.

The rostrum is small, pointed, without spines, but with a small knob at its base ("dorsal organ"). The carapace is entirely without spines. The first two pairs of legs are developed, the third pair rudimentary. No trace of pleopods or uropods. Telson triangular, with eight pairs of spines.

Stage V. Length, 5·2 mm. (fig. 51, *d*).

The rostrum has now three dorsal teeth, and there is a pair of supra-orbital spines. The third abdominal somite is greatly enlarged and the abdomen sharply bent at this point.

The telson is long and slender (width about quarter length) with one pair of lateral spines and eight simple terminal spines of which the outermost is the largest.

The flagellum of the second antenna extends beyond the scale. Legs 1 and 2 are chelate, and the rest of the legs are fully developed, leg 5 being the largest.

The first four pairs of pleurobranchs are well developed, but the fifth is small. The pleopods are large.

First post-larval stage. Length, 6 mm. (fig. 51, *e*, *f*, *g*).

Rostrum short, with four dorsal spines, one of which is behind the orbit. Carapace with antennal and hepatic, but no supra-orbital spines.

First antenna. The outer branch has two thick basal joints, the second with a short process growing forwards as the incipient accessory flagellum. The slender distal part consists of four joints. Basal joint of the peduncle with well-developed otocyst and small stylocerite. At its distal end there is a small outer lamella with outer spine as in the post-larval *Leander*.

All the legs are broken off, but the exopodite of the third maxillipede remains and, as is the case in *Leander* at this stage, has no setae.

The telson has two pairs of lateral spines and three pairs terminal. The epimera of the abdominal somites are all round.

It is impossible to identify such a specimen in the first post-larval stage with any precision, especially as at this stage the mandible palp and the gills of the third maxillipede may not be developed, but there can be little doubt, from the presence of an hepatic spine and the six spines of the telson, that it is a member of the Pontoniinae, and possibly of the genus *Periclimenes*.

Coutière has described (1905 and 1907, p. 59) a post-larval Palaemonid of 21 mm. which he refers to *Periclimenes*.

The presence of vestigial exopodites indicates an animal in the first post-larval stage, and Coutière is not therefore justified in attaching importance to the absence of a mandible palp. Except for this one character there is nothing in the description to support the reference of the specimen to *Periclimenes* rather than to *Palaemon*. The large size seems strongly to suggest that it was in fact a post-larval form of some species of *Palaemon*. It should be pointed out that the preceding larval stage might well have been as large as any Retrocaris larva known!

Pontoniinae. Species II (fig. 52).

In the Bay of Islands, New Zealand (station 148), a complete series of larvae from stage II to the first post-larval was taken which I do not doubt belong to one species. The general resemblance of these larvae to the form just described is so close that they no doubt belong to allied genera though probably not to the same genus.

Stage I. Length, 1·75 mm.

Scale of second antenna jointed, the endopodite with one seta.

Legs 1 and 2 developed, leg 3 rudimentary.

Telson triangular, 8 + 8. No pleopods or uropods.

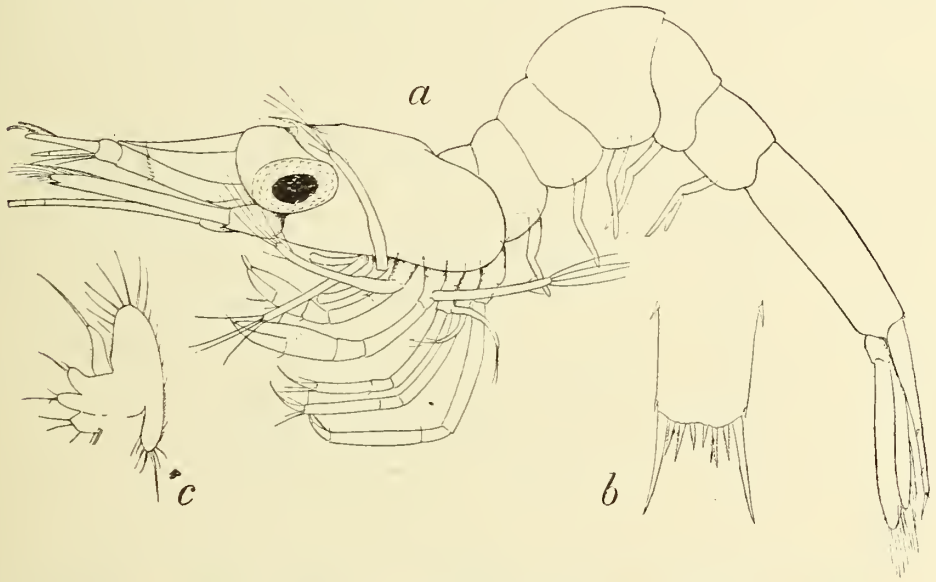

Fig. 52.—Pontoniinae. Species II. Station 148. Stage V. *b*. End of telson. *c*. Second maxilla.

Stage III. Length, 2·7 mm.

Ventral angle of carapace with two small spines.

Second antenna. Endopodite a rod shorter than scale. Scale not jointed.

Legs 1 and 2 developed, legs 3 to 5 rudimentary.

Traces of gills on legs 1 and 2.

Telson narrower. Uropods present, the endopodite without setae.

Stage IV. Length, 3·85–4 mm.

Flagellum as long as scale, the latter with terminal tooth.

Legs 1, 2, 3, and 5 developed, leg 4 rudimentary.

Uropods with endopodite bearing setae.

Telson narrow, formula 6 + 6.

Pleopods visible as small buds.

Stage V a. Length, 4·45–5·6 mm.

Flagellum longer than scale.

All legs developed. Legs 1 and 2 chelate.

Pleopods of varying size.

Stage V B (fig. 52). Length, about 7 mm.; last larval stage.

The rostrum is long, and without dorsal spines. The supra-orbital spines are large and serrated.

Abdomen greatly flexed at the large third somite.

None of the somites have spines.

First antenna. Both branches developing. Basal joint of peduncle curved, with large stylocerite, but no otocyst. The mouth-parts are of the usual Palaemonid form, the mandible having no palp and the second maxilla with only three lobes (fig. 52, *c*).

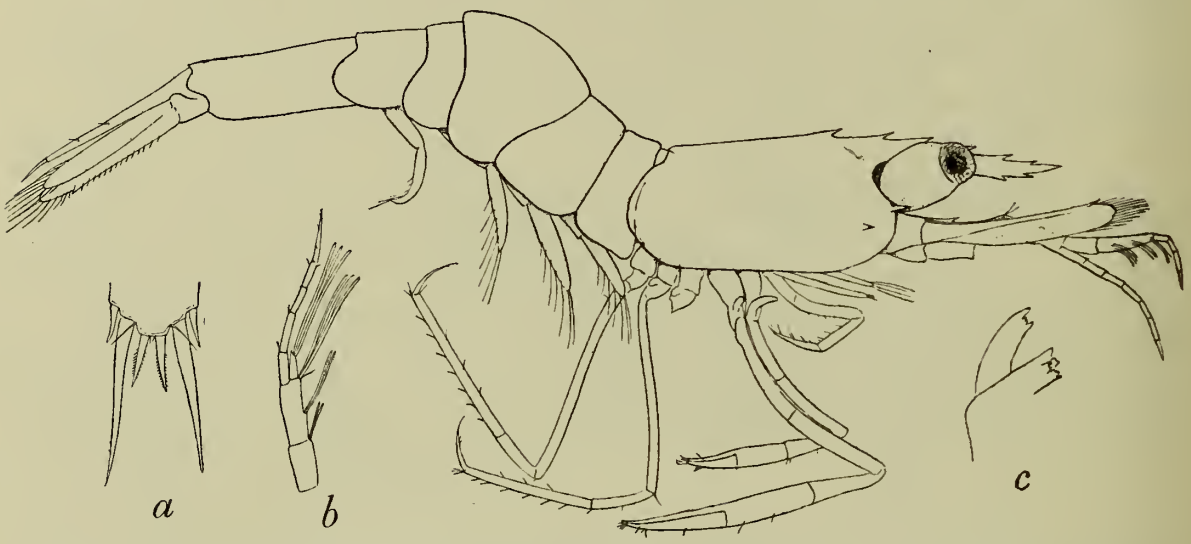

Fig. 53.—Pontoniinae. Species II. First post-larval. *a*. End of telson. *b*. End of first antenna. *c*. Mandible.

First maxillipede. Coxa and basis are fully developed, but the division between them is not marked by the slightest indentation.

Legs 1 to 4 have exopodites. Legs 1 and 2 have large chelae, the second being the larger. Leg 5 is larger than legs 3 and 4, but not markedly so.

Pleopods long, biramous, but without setae.

This larva differs from that above described in the absence of teeth from the rostrum.

Another larva was taken at station 85 which differs only in having a single toothed spine on the rostrum.

A single post-larval Prawn, no doubt belonging to the same series, was taken in the same collection (station 148). This specimen (fig. 53) measures 6·25 mm., or smaller than the oldest larva, but this is no reason for not accepting its identity since in *Leander* and *Palaemonetes* there is much variation in size of the last larva, and also the post-larval stage may moult from either stage V A or V B.

The armature of the telson places this species among the Pontoniinae, and it

appears to belong to the genus *Periclimenes*. The simple dactyli of the last legs would then restrict it to the subgenus *Ancylocaris* as defined by Kemp.

There are five pleurobranchs decreasing in size from before backwards and no trace of gills on the third maxillipede. In the first maxillipede the division between coxa and basis is scarcely indicated, and the epipodite is small and so deeply divided as to have the shape of a V with two equal curved branches.

Another post-larval Prawn was taken at station 129. This specimen has no supra-orbital or hepatic spine, and has small and slender chelae. The dactyli of the last legs are biunguiculate.

I should like here to call attention to certain facts regarding the relationship of the Palaemonidae to other families. If I am right in the identification of the larvae described above, the following conclusions may be drawn :

1. The larvae of the Palaemoninae have common characters which distinguish them from the Pontoniinae, but those of *Leander* and *Palaemon* differ from each other to a greater degree than would be expected.

2. The larvae of Palaemoninae and Pontoniinae possess characters in common by which they may as a whole be distinguished from all other Decapod larvae.

The most important characters are three :

(*a*) Absence of the basal lobe of the second maxilla.

(*b*) Retarded development of leg 4 and sometimes of leg 3.

(*c*) Precocious development of leg 5 and its great size.

Now these three characters are combined also in the *Alpheidae* and in *Lysmata*, but none are found in any other larvae known.

Coutière has emphasized the very close affinity of the Alpheidae to the Hippolytidae and the difficulty in defining the limits of the families, but he does not recognize any close resemblance to the Palaemonidae.

So far as concerns the larvae only it seems to me that this agreement in respect of these three characters demands explanation and implies some relationship, unless we are to follow Ortmann and dismiss all larval characters as irrelevant.

The question of the relation of *Lysmata* to the Alpheidae is more difficult since we are not dealing here with characters applicable to a whole family but only to a single genus.

The close resemblance between the Alpheid and Palaemonid larva is illustrated by the specimen shown in fig. 51, *h*, which probably belongs to *Athanas*. In general form it differs little from the Pontoniid shown in the same figure, and the long fifth leg and rudimentary legs 3 and 4 are exactly paralleled in *Palaemonetes varians*.

VIII. Processidae.

I have myself followed the development of *Processa canaliculata* (Gurney, 1923), and Coutière (1907) has attributed Bate's larval genus Hectarthropus to the Processidae, describing also a new species, *H. nikiformis*, which is remarkable for

the pronounced furrows on the carapace. Bate's species are not sufficiently described to be discussed, but Coutière's species, unlike though it is to *Processa*, must apparently be included in the family. As it cannot belong to *Processa* it may possibly belong to *Nikoides*.

No larvae of Processidae were recognized in the "Terra Nova" collections, but a single post-larval specimen of *Processa* was taken at station 135.

IX. Crangonidae.

Larvae of Crangonidae were taken at five stations, sometimes with post-larval stages, but they cannot be identified with certainty and add nothing to our knowledge of the family, which is already fairly complete.

PALINURA.

Of the development of the Eryonidea little is known (see p. 105), except that *Willemoesia* has an abbreviated development (Doflein, 1904). Of the Scyllaridea the metamorphosis is now completely established, although the whole series of changes has only been followed in *Palinurus vulgaris* and in *Scyllarus arctus*. The most complete and recent accounts of the development of these two genera are those of Bouvier (1914) and Stephensen (1923, p. 71). A Phyllosoma has been proved to exist in *Jasus*, *Panulirus*, *Ibacus*, and *Thenus*, and is probably universal. It is remarkable that, in spite of the fact that the Palinura hatch with the first three pairs of pereiopods developed, yet as many as nine or ten stages can be distinguished, and very large sizes may be attained by the larva. There is evidently a very prolonged larval period which should lead to very wide dispersal of the adults. *Jasus lalandi* is an example of such wide distribution, being found off the coasts of S. Africa, Chile, New Zealand, and Australia, besides Tristan da Cunha and St. Paul's Rocks in the Atlantic. The Phyllosoma of *Jasus* is exceptional in hatching with a large biramous natatory second antenna, and it has been given the name of Naupliosoma by Gilchrist (1913, 1916). Precisely the same larva has been found by Archey (1916) to hatch from the eggs of the New Zealand form of the species. The Naupliosoma stage lasts from four to six hours, and evidently corresponds to the transitory free stage sometimes found in the Brachyura (e.g. *Eurynome*), in which the embryonic cuticle is not yet thrown off and the antennae and telson are provided with large ciliated setae. There is no corresponding stage in *Palinurus vulgaris*, neither is there any trace of antennal setae in the larva before hatching.

It is difficult to make any comparison between the Phyllosoma and any other Decapod larvae. It cannot be said that it gives the slightest indication of the relationship of the Palinura, and, apart from the fact that some of the pereiopods are functional on hatching, there is no resemblance between it and the larva of the Nephropsidea. Claus (1876, p. 50) has already pointed out that the Phyllo-

soma unites in itself certain characters of the Protozoea and of the Mysis stage, and the presence of a biramous antenna in *Jasus* adds to the force of the contrast. The Phyllosoma is, in fact, a Protozoea in which structures properly belonging to later stages appear precociously.

Phyllosoma larvae, generally in the first stage, are not uncommon in the "Terra Nova" collections, but add nothing to our knowledge and need not be described. It should be noted, however, that some of these specimens show that the order of the appearance of the appendages does not always follow exactly that established for *Palinurus* and *Scyllarus*.

ASTACURA.

No larvae belonging to this section were taken by the "Terra Nova."

STENOPIDEA.

Stenopus hispidus.

The larva of this interesting species was first described by Brooks and Herrick (1891), the latter having observed the hatching of the young from the egg and therefore placed the identity of the first larva beyond doubt. Their detailed description of the segmentation of the egg and of the first Zoea is most valuable, but unfortunately the three subsequent stages described as belonging to *Stenopus* are undoubtedly referable to three other and very distinct genera. Thus the larva described as resulting from the first moult of the *Stenopus* Zoea certainly belongs to a species of *Callianassa*, while the two later stages (Pl. IX and XII) represent respectively the Mysis stage of *Lysmata*, or an allied genus, and a Mastigopus stage of *Sergestes* (probably that of *S. vigilax*).

Ortmann (1893) has already pointed out the error with regard to the last two stages, but he did not realize that even the second stage, stated to be derived by actual moult from the first in the laboratory, belonged also to quite a different genus of Decapod.

Curiously enough, Cano was engaged at about the same time in a study of the metamorphosis of *S. spinosus*, and his account was published on January 15, 1892. Cano described three stages of the larva and two post-larval stages, and his first stage agrees in all essentials with the first stage of the American species, though it differs in some details and agrees more closely with the second stage of the latter, to be described below. Cano does not state that he hatched the larva from the egg.

A few specimens belonging to four stages in the development of *Stenopus* were taken at stations 43 and 45 off the Brazilian coast, and as the genus possesses exceptional systematic interest some account of these larvae should be of interest, even though it may to some extent merely confirm that already given by Cano.

Stage I. Length, including rostrum, 3·1 mm. (fig. 54, *a*). Length of rostrum, 0·8 mm.

Brooks and Herrick give a length of 4 mm., of which 1·5 mm. was taken up by the rostrum, which was therefore much longer than in my specimens.

Carapace deeply indented dorsally above the sessile eyes, leaving uncovered the whole of the enormous mandibles. Rostrum at this stage smooth and slightly upturned towards the end. Posteriorly the ventral edge of the carapace is minutely denticulate and terminates in a sharp tooth.

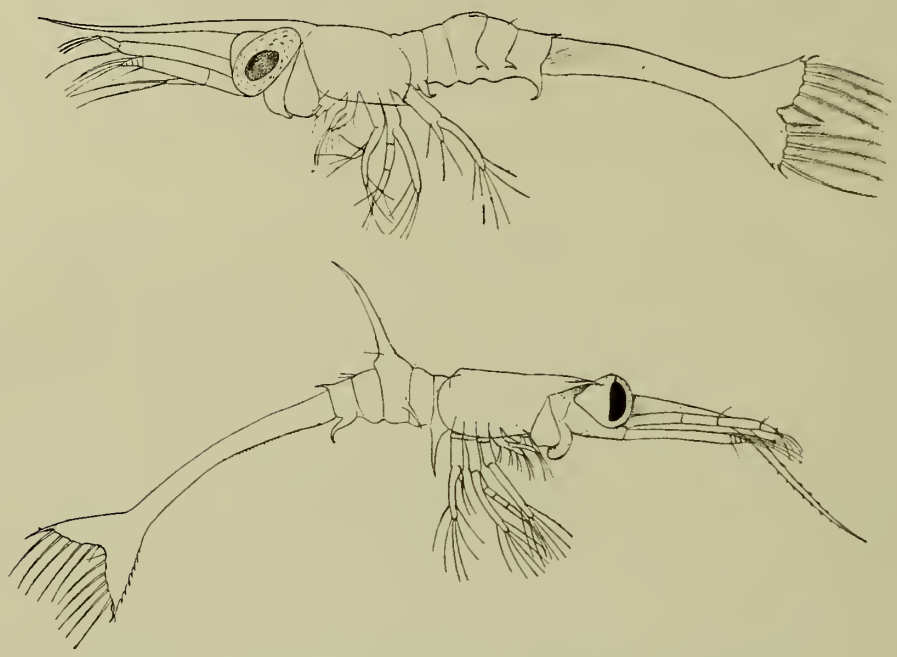

Fig. 54.—*Stenopus*, sp. Station 43. *a*. Stage I. *b*. Stage III.

First, third, and fourth pleon segments have each a pair of lateral spines, while the fifth has a strong ventral procurved spine and a small dorsal spinule. The third somite has no dorsal spine at this stage. In this respect it differs most strikingly from the first stage figured by Cano, and to a less extent from that of *S. hispidus* in which there is a short spinous prolongation of the segment. The sixth segment, which is not separated from the telson, is of great length, greatly exceeding that of the first five segments combined.

The telson is triangular, not very deeply incised, and therefore of the form characteristic of most Caridea. At each outer angle is a small spine, and it bears on the posterior margin twelve setae, of which the outermost is very small and is not ciliated. The second seta (the third of the whole series) is very long and ciliated along its inner side only.

The first antennae are very long, consisting of a single-jointed peduncle bearing a short outer branch. The inner ramus is represented by a seta mounted on a bulbous base.

The second antennae consist of a stem bearing a narrow scale with four terminal joints and an inner branch bearing two long setae.

There is a very large upper lip, and an enormous mandible without a palp.

The first maxillae have the usual pair of inner lobes or laciniae, but are remarkable for the total absence of a palp. In Cano's figure of this appendage in his first stage a very small protuberance is shown which may indicate the rudiment of a palp.

The second maxillae have four well-defined basal lobes, an inner ramus which shows indications of two joints, and a very small exopodite (scaphognathite) bearing five setae, of which the proximal one is very large. Brooks and Herrick figure this appendage from a larva before the first moult, and show apparently no trace of an exopodite. On the other hand, Cano's figure shows a large scaphognathite with numerous setae, which tends to confirm my opinion that his first stage is really the second.

The first maxillipede consists of a stem with two distinct joints, an obscurely three-jointed endopodite, and a short exopodite bearing four setae.

The second and third maxillipedes have long endopodites of four joints, the fourth and fifth not being separated. The exopodite bears in each case six setae.

The first pair of pereiopods are present as biramous appendages, the endopodite consisting of a single short joint. There is no trace of any other appendages.

Stage II. Length, 4·35 mm. Rostrum, 1·52 mm.

This stage is precisely the same as the preceding stage with regard to the appendages, but differs in the following respects:

1. The rostrum is now armed with numbers of small spinules towards the end.
2. The ventro-lateral pair of spines on the first somite of the pleon are greatly enlarged, and the third somite bears a huge dorsal spine as figured by Cano.

Both dorsal and lateral spines of somite 5 are larger, and the sixth somite has small spinules on its ventral surface. The fourth somite has lost its pair of lateral spines, and the form and armature of the telson have changed considerably. In place of the broad triangular form the telson now has two narrow divergent arms and bears a series of short spines along its outer margin. Each arm terminates in a strong smooth spine, and, as before, there are six pairs of posterior setae of which the outermost is minute and is now ciliated. The outer terminal spine obviously corresponds to a seta, and the armature is therefore 7 + 7 setae. The reduction of the second seta to a minute hair is a character of great importance to which I shall return later.

Stage III. Length, 5·45 mm. (fig. 54, *b*). Rostrum, 2·05 mm.

This stage differs in no essentials from the preceding stage with the exception that a minute knob represents the second pereiopod, and there is an additional seta on the telson. Further, the inner branch of the first antenna appears and a large supra-ocular spine is developed.

Stage IV. Of this stage I have no specimens, but the larva figured by Cano (fig. 1, *b*) measuring 8 mm. evidently succeeds the stage just described. In this stage, according to Cano, there are still no additional functional legs, but the four posterior pairs are present as rudiments, of which the first two are biramous. The uropods are developed, the internal branch having no setae.

The next stage in the series is represented by a larva of 14·8 mm. taken by the "Terra Nova" at station 45. Having regard to the great increase in size, I think

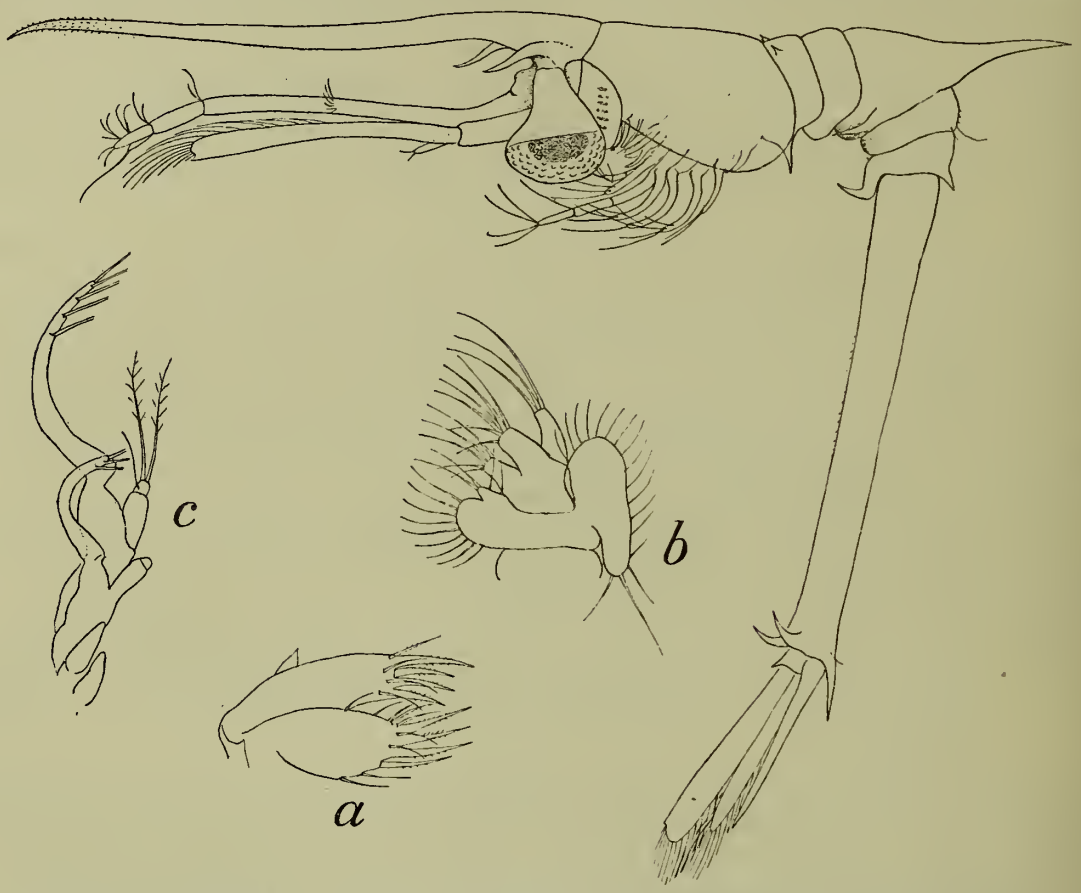

Fig. 55.—*Stenopus*, sp. Station 45. Stage VI. *a*. First maxilla. *b*. Second maxilla. *c*. Legs 2 to 5.

it probable that it represents a sixth stage rather than the fifth which remains unknown.

Stage VI. Length, 14·8 mm. Rostrum, 4 mm.

This larva is of some special interest as it is at once recognizable as being a slightly earlier stage of the form described by Ortmann (1893, p. 85) as *Embryocaris stylicauda*. Ortmann's specimen was taken off the Brazilian coast in much the same region as the "Terra Nova" specimens, and no doubt belongs to the same species—probably *S. hispidus*. The differences between this larva and stage III are, with the exception of the changes in the telson and uropods, rather of degree than of the appearance of new characters.

The supra-ocular spines are larger. The first somite of the pleon bears a pair of small dorsal spines in addition to the pair of ventro-lateral spines. The median ventral spine of the fifth somite is bent forwards at right angles to form a peculiar hook.

The telson is separated from the sixth somite and is now a narrow linear plate, forked at its extremity, and with four small hairs within the depression of the fork. All the setae of the early stages seem to have been lost and the form has entirely changed. The sixth somite terminates in a large dorsal spine and a pair of ventral spines curving forwards.

The stem of the first antenna is three-jointed, and the inner branch nearly equals the outer in length.

The inner branch of the second antenna is a very short rod, with two delicate setae.

The mandible still has no palp.

The first maxilla now has a trace of a palp as a small triangular excrescence without setae (fig. 55, *a*).

The second maxilla is a distinctly four-jointed appendage, the second joint bearing a bi-lobed lacinia, and the third two deeply separated lobes. The exopodite is a large setiferous plate (fig. 55, *b*).

The maxillipedes are as before, and I have not seen any trace of an epipodite on the first pair.

The first three pairs of pereiopods are developed, with setiferous exopodites, but the endopodites are very small, two-jointed, those of legs 1 and 2 with three setae on the terminal joint. That of the third leg has no setae. These three endopodites are borne, not at the end of the basipodite, but about half-way down it, in this respect resembling *Jaxea* and certain other Anomura.

Legs 4 and 5 are present as minute uniramous rudiments.

There is no trace of pleopods.

Gills are not yet developed, though a small papilla above the first and second leg may represent the first pleurobranch.

Stage VII. Of this and later stages I have no specimens, but both Ortmann and Cano described a stage which is evidently the last larval stage. Ortmann's specimen measured 19 mm., while Cano's had the enormous size of 30 mm. In this larva the general form is the same as before, but all the pereiopods are developed and the endopodites of the first three are chelate, though functionless and indistinctly jointed. The last two pairs are uniramous.

As regards the pleopods Cano and Ortmann differ. The former states that there are five pairs, of which the first pair is uniramous, while Ortmann says that the first somite bears no pleopods and that the four pairs present are uniramous. On the other hand Cano's figure shows the first somite without pleopods, so that I accept Ortmann's statement as applying to both forms. It is unfortunate that any doubt should attach to a question of so much importance.

Stage VIII. This is the first post-larval form described and figured by Cano (fig. 1, *d*). The adult characters are to a large extent assumed, but the abdomen is shown as flexed at right angles at the third somite, which shows a pronounced Caridean hump. Cano's figure shows no pleopod on the first somite. According to Cano the gills are present in their full number with the exception of the arthrobranch on the first maxillipede.

The development of *Stenopus* as here described is remarkable in several respects and seems to me to throw some light on the systematic position of the genus.

1. The larva is unique among Decapods in having when hatched four pairs of natatory limbs. In the Caridea there are three only, and in Reptantia there are, as a rule, only two. Further, it is a general if not universal rule, in Caridea and also in Reptantia, where the larval series is complete, that the uropods appear at the second moult. In *Stenopus* apparently they are first developed in stage IV.

The pereiopods also do not develop in the same way as in the Caridea, since the posterior pairs are delayed till the sixth stage, whereas they appear much earlier as a rule both in Caridea and in Reptantia.

2. The general appearance of the larva is quite distinctive, but resembles most closely the Mysis stage of the Penaeidea, particularly with regard to the great size of the rostrum and supra-orbital spines, and the median dorsal spines of the third, fifth, and sixth pleon-somites. But whereas the huge spine is borne by the third somite in *Stenopus*, it is on the second in the Penaeidae and the resemblance does not extend to the appendages.

3. In some characters *Stenopus* resembles in a remarkable way certain of the Reptantia.

(*a*) The telson. The reduction of the second pair of marginal spines to a small hair is a character confined to *Stenopus*, the Thalassinidea, and the Anomura. Such an apparently trivial modification can hardly be conceived of as independently acquired. The exact resemblance in form of the telson in the later stages to that of *Jaxea*, together with the great development of the dorsal and lateral spines on the end of the sixth pleon-somite is very striking. Even the serration of the outer margin of the telson, which is not found in any other Decapod larva, is the same in the two genera.

The great development of spines on the pleon-somites is also a character found more commonly among Penaeidae and Reptantia than in Caridea.

In fact the general facies of the larva in the "Embryocaris" stage is such that, at first sight, it would undoubtedly be referred to the Thalassinidea.

(*b*) The absence of a pleopod from the first somite of the pleon is entirely unknown among the Natantia, either larval or adult, and it is absent only in the adults of some Reptantia. It is absent from the larvae of all Thalassinidea whether present in the adults or not.

(*c*) The reduction of the endopodites of the third maxillipede and the first three

pereiopods, and their place of origin far from the distal end of the basipodite, is a feature which is found elsewhere only in the larvae of some Thalassinidea and Anomura, e. g. *Upogebia*, *Jaxea*, *Galathea*, and *Eupagurus*.

Of the development of the remaining genera of the Stenopidea—*Spongicola*, *Engystenopus*, and *Richardina*—practically nothing is known.

Spence Bate (1888, p. 216) reproduces a drawing by Willemoes Suhm of the first-hatched larva of *Spongicola*, of which Suhm says that it is "a Zoea in which, however, some appendages are to be seen which, as a rule, come out only in a later stage." His figure shows a very remarkable animal with sessile eyes, but with five pairs of thoracic appendages of which the third and fourth only are biramous. These appendages must be the three pairs of maxillipedes and two pairs of pereiopods. The body behind the carapace is shown with six distinct somites and a long unsegmented posterior portion. If this figure is correct, which it is difficult to believe, the larva of *Spongicola* is even more strange than that of *Stenopus*. On the other hand, Bate himself figures a larva taken from the egg having only the first two maxillipedes developed and the abdomen unsegmented. Both agree in representing the carapace as very short and leaving part of the thorax uncovered, a feature recalling the Penaeid Zoea, and in the form of the telson, which closely resembles that of *Stenopus*. As is the case in *Stenopus* the telson has an outer spine and five setae on either side, but it is probable that the minute second seta was also present in *Spongicola* but was overlooked.

In *Richardina* the eggs are very large (2 mm. in long diameter in *R. spinicincta* and in *S. fredericii*) and development consequently abbreviated. Kemp (1910, p. 169) has examined larvae taken from the eggs of *R. spinicincta* and finds that "all the pereiopods and pleopods are present, though the uropods are not yet free." The telson is deeply bifurcate as in *Spongicola venusta*.

The position of the Stenopidea in Decapod classification has long remained a matter of uncertainty.

De Haan (1850) included *Stenopus* with the Caridea, but Huxley in 1883, dividing the Decapods on the basis of gill structure, placed it in his group of Trichobranchiata, wherein were contained the Thalassinidea, Homaridea, and Penaeidea. Spence Bate (1888) followed Huxley in laying stress on the structure of the gills, but separated the Penaeidea in a new group, the Dendrobranchiata, leaving *Stenopus* with the Astacidea.

Boas (1880), on the other hand, definitely included the Stenopidae as a family of the Penaeidea. Ortmann (1896), while retaining them among the Natantia, separated them from the Penaeidea as a division Stenopidea equivalent to the Penaeidea and Eucyphidea. Alcock (1901), though he did not adopt Boas's primary division, included the Stenopidea in his Macrura Caridides. Finally Calman (1909), while expressing some doubt as to their affinities, leaves the Stenopidea in the same position as Ortmann, namely, among the Natantia.

The prevailing opinion therefore has been that the Stenopidea hold a position intermediate between the Caridea and the Penaeidea, with, on the whole, a greater relationship to the latter.

It seems to me that this view is not altogether in accordance with the structure of the adult, and is certainly not supported by the larval history.

So far as concerns the adult, *Stenopus* seems to have practically no relationship with the Caridea. The only structural points of agreement of any importance are the possession of a well-developed antennal scale and the relatively large size of the first abdominal somite. Neither of these characters can be regarded as of great significance, while there are many serious points of difference.

With the Penaeidea the relationship is very much closer; but, on the other hand, it is very striking that *Stenopus* resembles the Penaeidae mainly in just those characters in which the latter resemble the Reptantia. Ortmann (1890) has given a statement of the resemblances to the Penaeidea as follows:

1. The first three pairs of pereiopods are chelate.
2. The endopodite of the third maxillipede is seven-jointed.
3. The exopodite of the first maxillipede has not the basal enlargement characteristic of the Caridea.
4. The inner lobe of the first maxilla is rounded.
5. The mandible is undivided.
6. The pleopods have no appendix interna.

All these characters are shared with the Reptantia.

The Stenopidea differ from the Penaeidea in the following points:

1. The gills are trichobranchs.
2. The chela of the third pereiopod is the strongest.
3. The epimera of the first abdominal somite slightly overlap those of the second.

With regard to the first point the Stenopidea resemble some Reptantia. The second is hardly a point of serious difference from the Penaeidae, in which the third pereiopod is usually the longest, while the third character is peculiar to the Stenopidea.

A character which is not mentioned by Ortmann, but which seems to me to be of some importance, is the possession of a distinct exitic lobe on the first maxilla of *Stenopus*. This lobe, which is so striking a feature of the first maxilla of Euphausids, is found in a number of Reptantia (e. g. *Upogebia*) but very rarely in Caridea. The only instance known to me is that of *Atyaëphyra desmarestii*, but it is not present in the nearly allied genus *Caridina*. It is true that this exite is a primitive structure present in the ancestral Decapod and therefore it may be expected to be retained in some Caridea, but it has been almost entirely lost in that group and is not infrequently found in Reptantia.

With regard to its gill formula *Stenopus* differs radically from the Caridea, and agrees perhaps better with the Penaeidea than with the Reptantia (Homaridea).

I have, through the kindness of Dr. Calman, been able to examine a specimen of *Stenopus* from Penang and find that it has a pleurobranch also on the second maxillipede and a rudiment of a podobranch on the third maxillipede, the total number of gills therefore being 21 + 7ep. instead of 19 + 7ep. as usually given. In total number, therefore, the formula is one of the most complete known and is evidence of the primitive position of the genus.

It seems to me that, on the evidence of the adult structure, *Stenopus* holds a position between the Penaeidea and the Homaridea.

If we now consider the evidence to be drawn from the structure of the larva, the first conclusion, namely that *Stenopus* has no relation to the Caridea, is fully borne out. The differences are pointed out above (p. 138) and need not be further discussed here.

On the other hand, it is by no means easy to decide to what relationship the facts actually do point. The larva has certain quite distinctive characters of its own, but in general form it presents somewhat of a combination of Penaeid and Thalassinid characters. The huge spiny rostrum and large supra-orbital spines recall the Penaeids, but the arrangement of the dorsal spines on the abdomen agrees more closely with that of the Reptantia such as *Nephrops* or some Thalassinidea. The large supra-orbital spines, however, are the only feature which can fairly be said to be shared with the Penaeidea, such spines being absent from the Reptantia as a rule. They are, however, present in *Nephrops*.

But it is to the detailed structure of appendages and telson that we must turn rather than to the general body-form in seeking for real evidence of relationship, and here we have certain well-defined characters which must be regarded as of phylogenetic significance. These are the form and armature of the telson, and the form of the third maxillipede and first two pairs of pereiopods. As has been noted above, the telson almost exactly resembles that of *Jaxea*, while the reduction of the endopodite of the third maxillipede and its point of origin near the base of the basipodite are characters otherwise confined to *Jaxea*, *Naushonia*, and *Upogebia* among Thalassinidea, and to the Anomura. The reduction of the second seta of the telson implies close relationship with the Thalassinidea and Anomura rather than to the Homaridea. In the same way the peculiarly twisted and rudimentary pereiopods in the last larva sharply distinguish *Stenopus* from the whole of the Natantia and also from the Homaridea, but rather closely resemble those of the Anomura.

The absence of the first pair of pleopods from the last larva is a character of some importance. The appendage is invariably developed in the Penaeidea and Caridea but is absent from the larva of the majority of the Reptantia.

So far, then, as the development goes, *Stenopus* must certainly be placed among the Reptantia, and within that group it finds its nearest kin in the Laomediidae and the higher Anomura.

THALASSINIDEA.

Thanks to the work of Sars, Cano, Thompson, and Miss Webb, we are acquainted with the larvae of representative species of each family of the Thalassinidea except the Thalassinidae, while some larvae of this tribe have been described by Bate and Ortmann under the names of Oodeopus, Anomalocaris, and Sestertius.

As these larvae are not uncommon in the plankton and possess very distinctive features, I think it may be useful to summarize the information regarding each family before proceeding to describe the larvae from the "Terra Nova" collections belonging to that family.

I. Axiidae.

Species of which the development is known:

Axius stirhynchus, Leach. Miss Webb (1921) has described the larva and has shown that the larvae described under this name by Cano (1891) belonged to *Callianassa*.

Calocaris macandreae, Bell. Sars (1889). Björck (1913).

Characters of these species:

Rostrum broad, serrated in *Axius*.

Abdomen with or without dorsal spines. These spines when present are small (*Axius*).

Telson with median spine and numerous setae, the second seta reduced to a hair.

Mandible palp developing early.

Exopodites present on all pereiopods, but rudimentary on the last pair.

Endopodites normally placed and not reduced.

Pleopods absent from first somite.

Uropods not developed in larva (*Axius*), or developed but not functional (*Calocaris*).

It is probably a general rule in the family that development is abbreviated, the eggs being usually of great size. In *Axius stirhynchus* they measure $2{\cdot}5 \times 1{\cdot}2$ mm. and the larva possesses all its appendages except the uropods on hatching. In *Calocaris* also there are apparently only two larval stages.* In all the species of *Eiconaxius* and of *Iconaxiopsis*, so far as I can find, the eggs are large—e.g. *E. kermadecensis* $1{\cdot}7 \times 1{\cdot}3$ mm.

In the case of *E. parvus* Bate extracted the embryo, and his figure shows (1888, Pl. V, fig. 5) that the animal leaves the egg in practically the adult form.

On the other hand, within the genus *Axius* there are certainly species with eggs of normal size and an extended metamorphosis. For instance, the eggs of a species of *Axius* from the West Indies in the collection of the British Museum

* The earlier stages attributed to *Calocaris* by Sars belong to *Callianassa*. Only that represented on Table 2 belongs to *Calocaris*.

measure 0·55 × 0·4 mm. The young extracted from them have three pairs of biramous appendages only, though I am unable to say if there are rudiments of the succeeding limbs.

The presence of a rudiment of the exopodite on the fifth pair of pereiopods is a character of great importance which may be distinctive of the larvae of the Axiidae as compared with other Thalassinidea. Among the Reptantia it is only the Homaridea, to which the Axiidae are in other respects also closely related, that have an exopodite on this leg. It must be regarded as a most primitive character found elsewhere only in the Penaeidea and the Hoplophoridae among Caridea.

Miss Webb states (1921, p. 407) that the last two pairs of legs are uniramous in the larvae of *A. stirhynchus*, but I have had the opportunity of studying specimens from Plymouth and find the rudiment of the exopodite to be quite distinct on each of these appendages.

In the "Terra Nova" collections there are larvae of the "Oodeopus" form with exopodites on the last leg, and these I refer with some confidence to the Axiidae. On the other hand, the same general form is undoubtedly characteristic of the Callianassinae, to which the majority of the Oodeopus larvae belong, and it may be that only those forms which combine the two characters of an exopodite on the fifth leg and of an indefinite number of setae on the telson should be included in the Axiidae.

In *Calocaris* there are no spines on the abdominal somites, while in *Axius* the dorsal spines are small and equal. It is probable that absence or reduction of these spines is an additional character that can be used to distinguish Axiid larvae from those of Callianassinae.

Axiidae. Species I (fig. 56).

Station 93. Length, 7·4 mm. to end of rostrum.

This larva is of some interest as presenting a transition from that of *Axius stirhynchus* to the Oodeopus form characteristic of the Callianassinae.

The rostrum is as long as the whole carapace and is flattened horizontally, with a row of denticles along each margin. The carapace has a sub-ocular spine, but its ventral margin is smooth. The second and third somites of the abdomen bear each a dorsal spine, that of the second being the longer, but the somite has no dorsal ridge as in *Callianassa*, and there are no lateral spines. The telson, which is not separated from the sixth somite, is triangular, with convex margin and a large median spine which is a prolongation of the telson plate itself. On either side there are ten relatively short spines, the second being reduced to a small hair.

The eyes are large, on short stalks, and without pigment.

The mandibles have a small papilla representing a rudimentary palp.

The three pairs of maxillipedes bear exopodites with 5, 5, 6 setae respectively, and their endopodites are fully developed, springing from the apex of the basipodite.

All the pereiopods are large, the first pair having a chela and the second being sub-chelate, while each bears an exopodite, these exopodites, however, having no setae.

There are four pairs of rudimentary pleopods, but the uropods are absent.

The first two maxillipedes bear epipodites, but I am not certain if there are

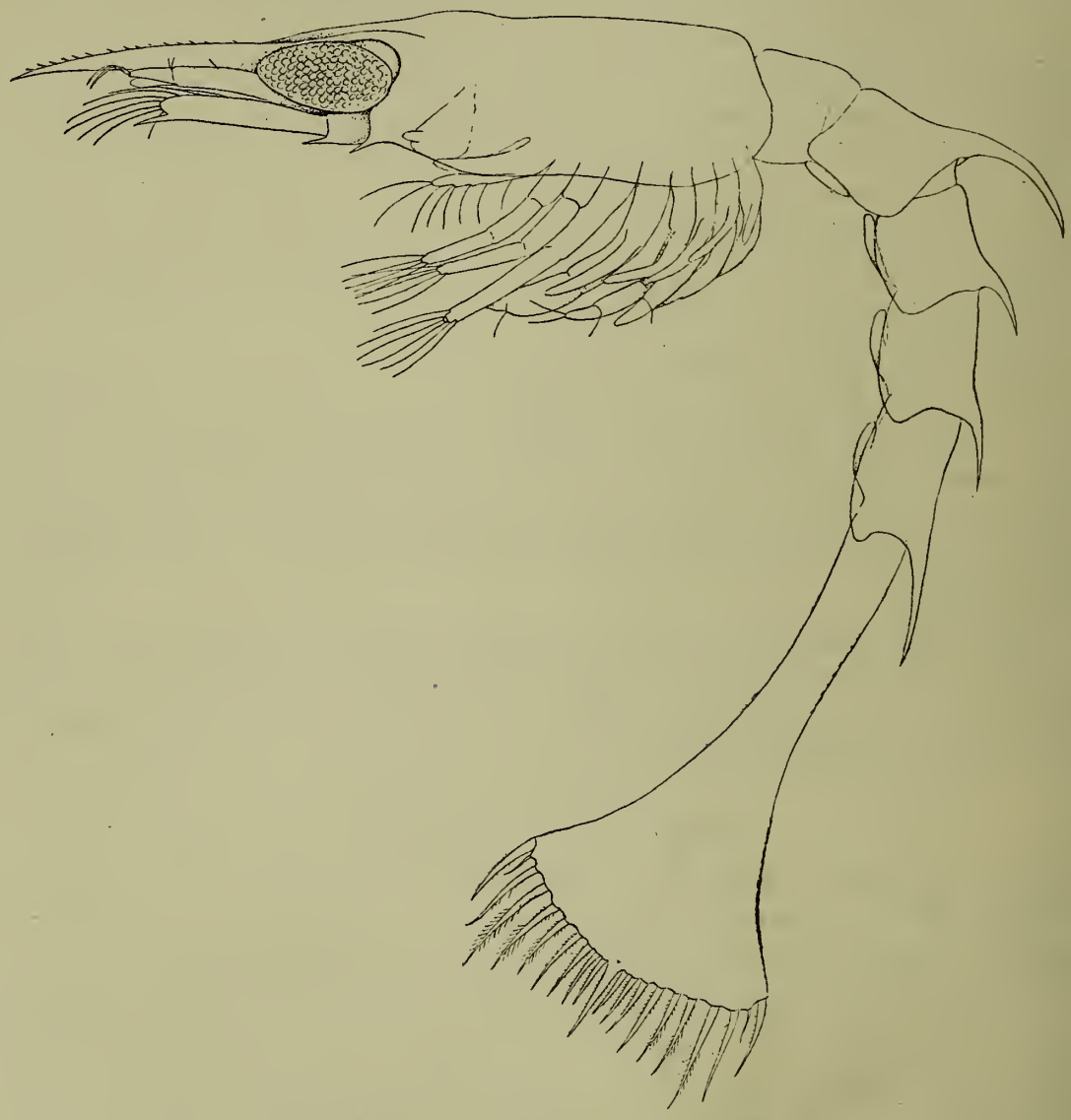

Fig. 56.—Axiidae. Species I. Station 93.

epipodites on the remaining appendages. I think I can detect a minute trace of an epipodite on each appendage except the fifth leg, but there are no gills.

This larva seems to correspond to the first stage of *Axius stirhynchus*, which in many respects it closely resembles. In *A. stirhynchus* in its first stage all the pereiopods are present, though the fourth and fifth are small, and the first three pairs bear exopodites without setae. In the last stage the exopodites of these three pairs have setae, while the fourth and fifth pairs have rudimentary exopodites.

The telson, though differing in its posterior contour and in the smaller number of spines, is distinctly of the same type. *A. stirhynchus* also has the second spine reduced to a hair, an important point which is not mentioned by Miss Webb. The complete suppression of the uropods in larval life is a curious feature which seems to be in some way connected in Caridea with abbreviated metamorphosis (e.g. *Palaemonetes varians macrogenitor*). Among the Thalassinidea it may be a characteristic of the genus *Axius*, but apparently not of the family, since uropods are developed (in a rudimentary form) in *Calocaris* and are present in some of the Oodeopus larvae described by Bate which, on other grounds, seem to be referable to the Axiidae. It is perhaps unsafe to place too much reliance on Bate's figures, particularly with regard to characters to which he would probably not have attached importance; but I am inclined to refer to some genus of the Axiidae his *Oodeopus geminidentatus* (Pl. CXLII, fig. 1) and *O. intermedius* (Pl. CXLIII, fig. 1). Ortmann's *Anomalocaris macrotelsonis* (1893, p. 87), although the form of the telson has a distinct resemblance to that of *Axius*, is probably rightly referred by him to the Callianassinae.

The identification of the larva just described with the genus *Axius* seems to me to be beyond question, but there remain a series of larvae which in some respects so closely resemble that of *Callianassa* that any positive identification seems to be impossible. This close resemblance is in itself of interest and importance, and for this reason I think it worth while to figure and describe some of these larvae even though they cannot be referred to their genera.

I accept provisionally the presence of a rudimentary exopodite on the fifth pereiopod, and of a pleopod on the second abdominal somite as characters distinctive of the Axiidae, although I am aware that this pleopod is developed in some Callianassidae (*Upogebia* and *Callianassa subterranea*) and the exopodite is figured by Bate in larvae which are probably referable to the Callianassinae.

Axiidae. Species II and III. (*Iconaxiopsis?*) (figs. 57, 58).

At stations 131 and 148 larvae were taken of two species so closely resembling each other that they certainly belong to the same genus and may be dealt with together.

Stage I. Length, 4·85 mm. Station 148 (fig. 57, *a*).

Rostrum long, not flattened, and with a few small teeth at the distal end. Carapace with a very long sub-ocular spine, and smooth (species II, station 148) or with a few small denticles (species II, station 131) on its ventral margin.

The abdominal somites are without spines, except the fifth, which has a median dorsal spine.

The telson is triangular, with a deep median cleft and a median spine. Spine formula 7 + 1 + 7, the second being reduced.

The second antenna has the endopodite as a short rod bearing three setae of

about equal length. The scale has no setae on its outer margin and no terminal spine.

The endopodites of the maxillipedes are well developed, and the exopodites bear 4, 4, 4 setae respectively. The pereiopods are traceable as five rudiments beneath the skin.

Species III appears to hatch in a rather more advanced condition, since the earliest

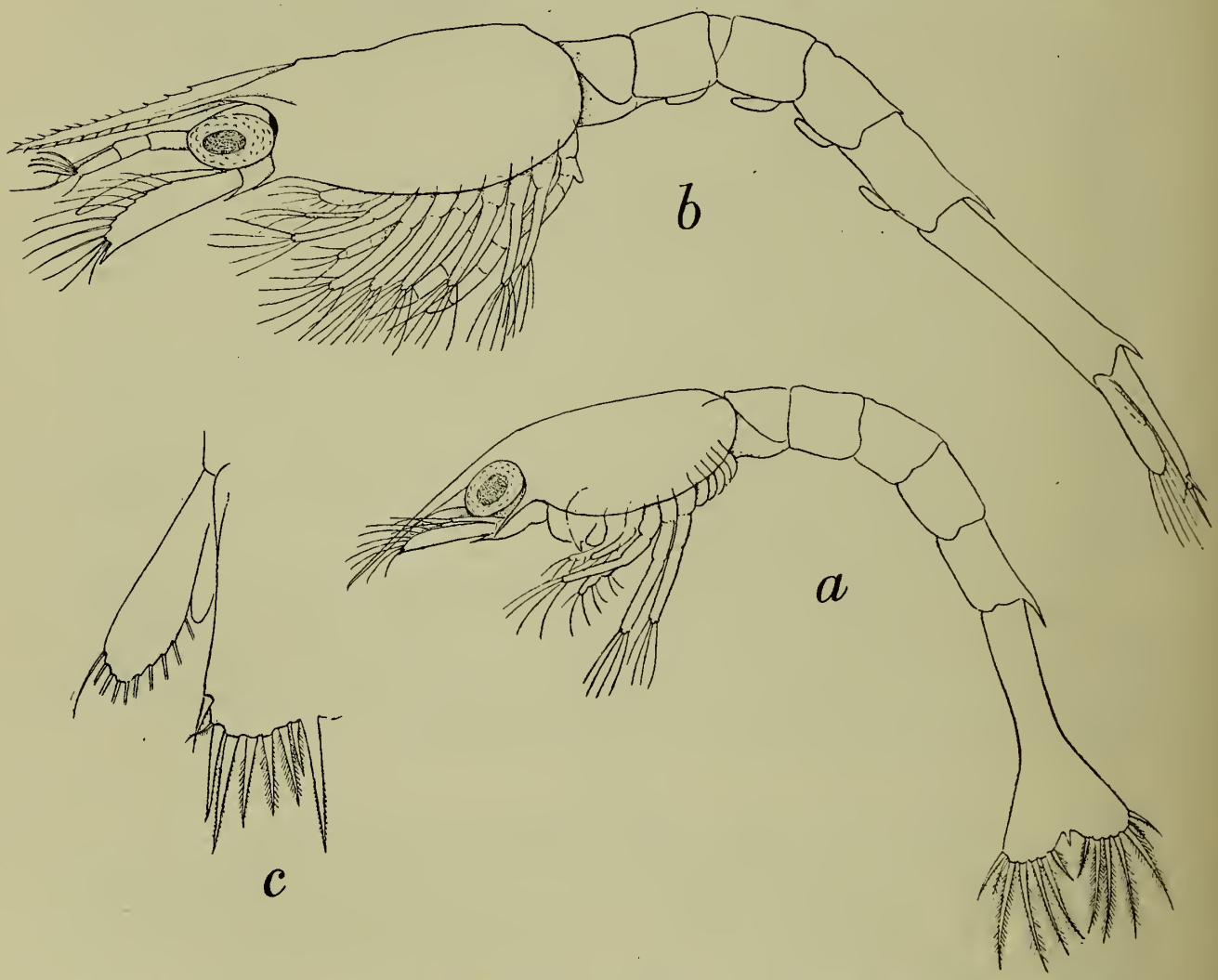

Fig. 57.—Axiidae. Species II. Station 148. *a*. Stage I. *b*. Stage III. *c*. Stage III. Telson.

larva found measures 5 mm. and the pereiopods are more developed. In most cases they are still beneath the skin, but in some specimens they are separated and are biramous.

Stage II. Length (species III), 6·45 mm.

The rostrum is broad, serrate, and constricted at the end, the carapace and abdomen as before.

The telson is of the same shape, but its formula is now 8 + 1 + 8 and the median spine is longer. The second seta is even more reduced.

The first antenna has the rudiments of both branches.

The scale of the second antenna has a terminal spine, but the endopodite has lost its setae and is a simple rod about two-thirds of the length of the scale.

With regard to the pereiopods there are differences between the two species. In both, these rudiments are all equally large and biramous, but whereas in species III the exopodites are all without setae, in species II those of legs 1 and 2 bear one or two setae.

Pleopods are absent, but are just traceable in some specimens of species III.

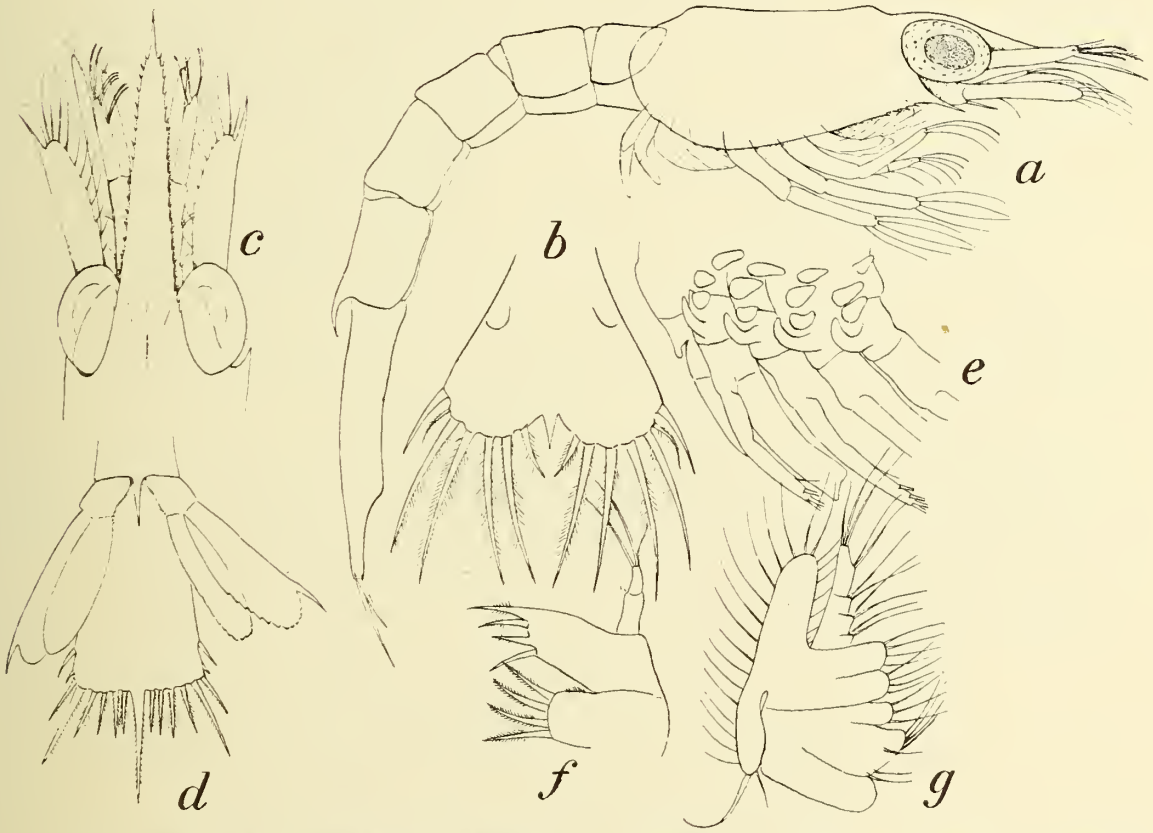

Fig. 58.—Axiidae. Species III. Station 131. *a*. Stage I. *b*. Stage I. Telson. *c*. Stage IV. Head. *d*. Stage IV. Telson. *e*. Stage IV. Gills. *f*. Stage IV. First maxilla. *g*. Stage IV. Second maxilla.

Stage III. Length (species II), 6·6 mm. (fig. 57, *b*).

In general form this stage does not differ from the preceding except that the telson is separated from the sixth somite, which has dorsal, lateral, and ventral spines, and the uropods have appeared.

The telson is longer and narrower, and the arrangement of the spines is changed. The median spine is very long, and there are eight spines on either side; but they are shorter and stouter than in stage II (fig. 57, *c*). The small reduced second seta remains the same.

All the pereiopods are well developed, the first two pairs beginning to become

sub-chelate. On the first four pairs the exopodite is functional, bearing 6, 5, 5, 5 setae, while that of the fifth pair is reduced to a small papilla.

Small pleopods are present on somites 2 to 5.

Gills are not yet developed, but there are traces of epipodites on each of the maxillipedes and on the first four pereiopods. The epipodite of the second maxillipede is exceedingly small.

Stage IV. Length (species III), 8 mm. (fig. 58, *c–f*).

This stage, which is the last before metamorphosis, is not represented in species II.

It differs from stage III only in the greater development of the appendages, the appearance of the gills, and the structure of the telson and uropods.

The endopodite of the antennae is much longer, while the palp of the mandible is long and unjointed.

The second maxilla is shown in fig. 58, *g*.

In the third maxillipede the endopodite consists of five joints, but the first and second are indistinctly separate and three small denticles on the inner edge of the first joint seem to indicate the appearance in the adult of a "crista dentata." The first leg is very large and chelate, while the second is slender and sub-chelate. The three succeeding legs are long, slender, and four-jointed.

The pleopods are large and biramous on somites 2 to 5, while the uropods are fully formed, both branches bearing setae. The telson does not differ greatly in shape from the preceding stage, but the arrangement of the three outer spines is not quite the same, the second being transformed from a ciliated hair into a small spine.

The gill formula is as follows:

	Ep.	Arth.	Pleur.	Exop.
Mxp. 1	1	—	—	1
Mxp. 2	1	—	—	1
Mxp. 3	1	2	—	1
Leg 1	1	2	—	1
Leg 2	2	1	1	1
Leg 3	1	2	1	1
Leg 4	1	2	1	1
Leg 5	—	—	—	rud.

The presence of pleurobranchs alone suffices to place this larva within the Axiidae, since all the other Thalassinidea have lost these gills. Even within the Axiidae the genera *Axiopsis*, *Calocaris*, and *Calocarides* may be excluded since they have no pleurobranchs; while within the genus *Axius* itself the sub-genera *Neaxius* and *Paraxius* have none. The sub-genus *Axius* may also be excluded since the larva is known and differs in many respects from that just described, so that only *Iconaxiopsis* and *Eiconaxius* remain. There are, it is true, other genera of the Axiidae described since the publication of Borradaile's revision of 1903, but I am not aware of the gill formulas of these genera.

Of *Eiconaxius* the three species hitherto described have direct development and are therefore excluded. There remains only the genus *Iconaxiopsis*, and it is therefore to this genus that I provisionally refer these two larvae. I am well aware of the slenderness of the grounds for doing so, but there is some advantage in attaching a name to the larva even if it may later prove to be incorrect.

Axiidae. Species IV (fig. 59, *a*, *b*).

At station 43 a larva was taken which I place with some doubt among the Axiidae by reason of the absence of a large dorsal spine on the second abdominal somite.

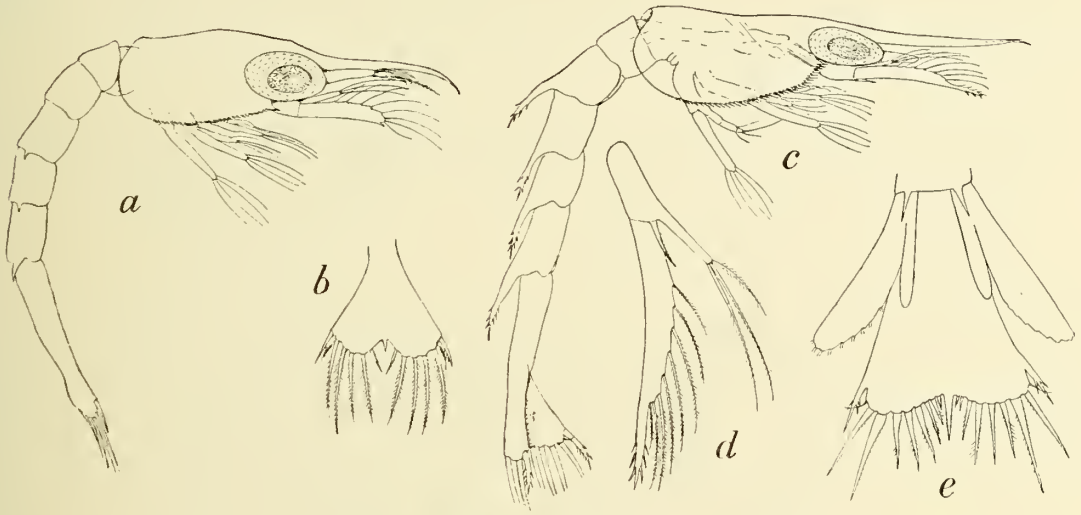

Fig. 59.—Axiidae. *a*. Species IV. Station 43. *b*. Species IV. Station 43. Telson. *c*. Allied species. Station 133. *d*. Allied species. Station 133. Second antenna. *e*. Allied species. Station 133. Telson. Stage III.

This larva, which measures 2·8 mm., is in the first stage, and therefore has not the distinctive features of the family.

The rostrum is very long, and has only one or two teeth at the distal end. The carapace is denticulate along the whole of its ventral margin.

The abdominal somites have no dorsal spines, but somites 3, 4, and 5 have each a pair of small lateral spines.

The telson is triangular, with a formula of $7+1+7$, the second seta reduced.

The endopodite of the second antenna has three long setae.

The three pairs of maxillipedes are fully developed, their exopodites having four setae in each case.

There is no trace of pereiopods.

A very similar form (fig. 59, *c*) was taken in some number at stations 122, 131, 133, and 135. This species is distinguished by having long spines on pleon-somites 2 to 5, each of which bears a series of denticles. The antennal scale also has a long denticulate spine.

II. Laomediidae.

The larvae of *Jaxea* (Cano, 1891, &c.) and of *Naushonia* (M. Thompson, 1903) have been described, and it is interesting to find that, strange as is the form assumed by the former, there are characters common to it and to *Naushonia* in respect of which both differ from other Thalassinidea. In fact the larvae provide the strongest evidence for the inclusion of *Naushonia* in the Laomediidae.

The characters of the two forms may be combined as follows:

Rostrum small.

Abdomen without dorsal spines, but with ventro-lateral procurved spines.

Telson deeply hollowed, the angles produced, without median spine. Second seta reduced. Formula 7 + 7, becoming numerous later.

Mandible sickle-shaped.

Two pairs of maxillipedes functional on hatching.

Endopodite of third maxillipede rudimentary and seated at base of basipodite.

Pleopods absent from somite 1.

Exopodites on first four pereiopods.

Jaxea, sp. (figs. 60, 61).

The very striking *Lucifer*-like larva to which the name of "Trachelifer" was given by Brook has been attributed by Claus, mainly on the evidence of the gill formula of the Mysis stage, to *Jaxea nocturna*. This identification is probably correct, though no one has obtained the larva from the egg or observed the transformation to the adult form. Even Cano, who described three stages in the development, was unable to obtain any post-larval stages. The larvae are but rarely taken on the British coasts, so that the opportunity seldom occurs of keeping living specimens in the last Mysis stage till their transformation.

In one plankton sample from the Bay of Islands (station 148) several specimens were taken of a larva which agrees in almost every detail with the European Trachelifer and must therefore be attributed to a species of *Jaxea*, though, on account of certain minor differences, it certainly does not belong to *J. nocturna*. So far as I am aware, the only species of the genus which has been described is *J. nocturna*, which has been taken in the adult state on rare occasions in the Mediterranean and round the British coasts. The larvae which I have to describe prove that a second species occurs in New Zealand waters, and probably in abundance.

The larvae represent five stages in the development, and form an almost complete series to the last Mysis stage.

Stage I. Length, 4·5 mm. (fig. 60).

This larva agrees in almost all respects with the first larva of *J. nocturna* figured by Cano (1891, Taf. IV, fig. 1, *a*), but it is not certain that this is the first stage hatched from the egg, since Claus has figured one which appears to be younger (1884, p. 32, Taf. VIII, fig. 48).

The mouth-parts are in all respects the same, the left mandible and the left paragnath being modified as slender sickle-shaped organs.

The first two pairs of maxillipedes are developed as biramous appendages, of which the endopodite is four-jointed, and the exopodite bears four terminal setae only.

The third maxillipede is represented by a uniramous rod, and there are two pairs of small papillae which are the rudiments of the first two pairs of pereiopods.

Each of the five abdominal segments bears a pair of lateral hooks curving forwards. In *J. nocturna* according to Cano the first somite has no spine, but I am doubtful if this is a real specific difference, since this spine is certainly present in a larva in a later stage (stage IV) taken on the Eddystone ground near Plymouth. This spine is, however, omitted from Bouvier's drawing (1914, fig. 1).

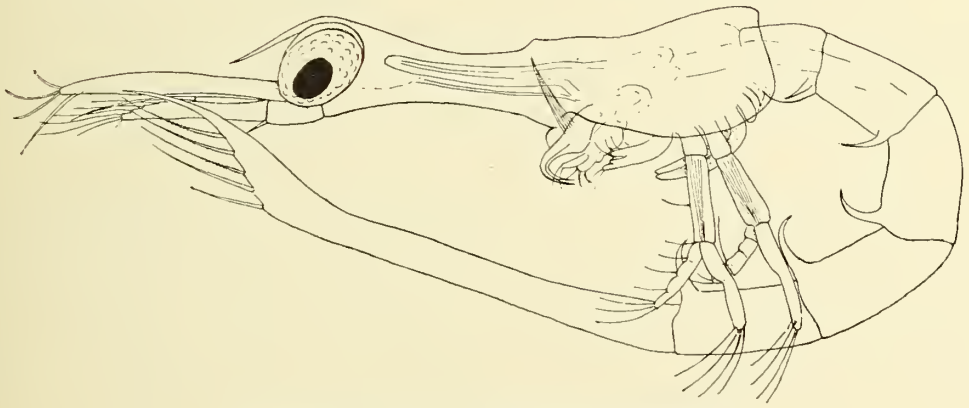

Fig. 60.—*Jaxea*, sp. Station 148. Stage I.

The telson is deeply cleft, with two narrow arms each produced into a slender spine, and there are five pairs of long spinous setae on the posterior margin. At the base of the outermost seta, and somewhat on the ventral side of it, there springs a very small hair. This hair, which is easily overlooked, is not shown by Cano, neither does Thompson show it in his figures of the nearly allied species *Naushonia crangonoides*. This and the stout terminal spine represent modified setae, the formula being the usual 7 + 7 setae. The specimen is approaching the moult, and the appearance of three more setae at the next stage is indicated beneath the cuticle.

Stage II. Length, about 6 mm. (fig. 61).

Of this stage there are three specimens. It differs from the first in the development of the third maxillipede which has an exopodite with five setae. The endopodite, however, is represented only by a small papilla half-way down the inner face of the basipodite.

The first pereiopod is a long biramous rod without setae, turned forwards and lying between the bases of the maxillipedes. The remaining legs are small papillae, the first of which is bi-lobed.

The telson is of the same shape as before, but with eight well-developed setae

on either side (the formula is therefore 10 + 10). It is not separated from the sixth somite, and the uropods are not developed.

The second maxilla is of somewhat unusual form (fig. 61, *e*). Bouvier's figure of this appendage at a later stage (1914, fig. 3) shows only the distal part of it, but it is correctly figured by Claus 1891 (fig. 4, *b*). It is actually a distinctly three-jointed appendage, the second and third joints bearing each a pair of endites or laciniae. The endopodite is a small papilla not separated from the distal endite, while the exopodite

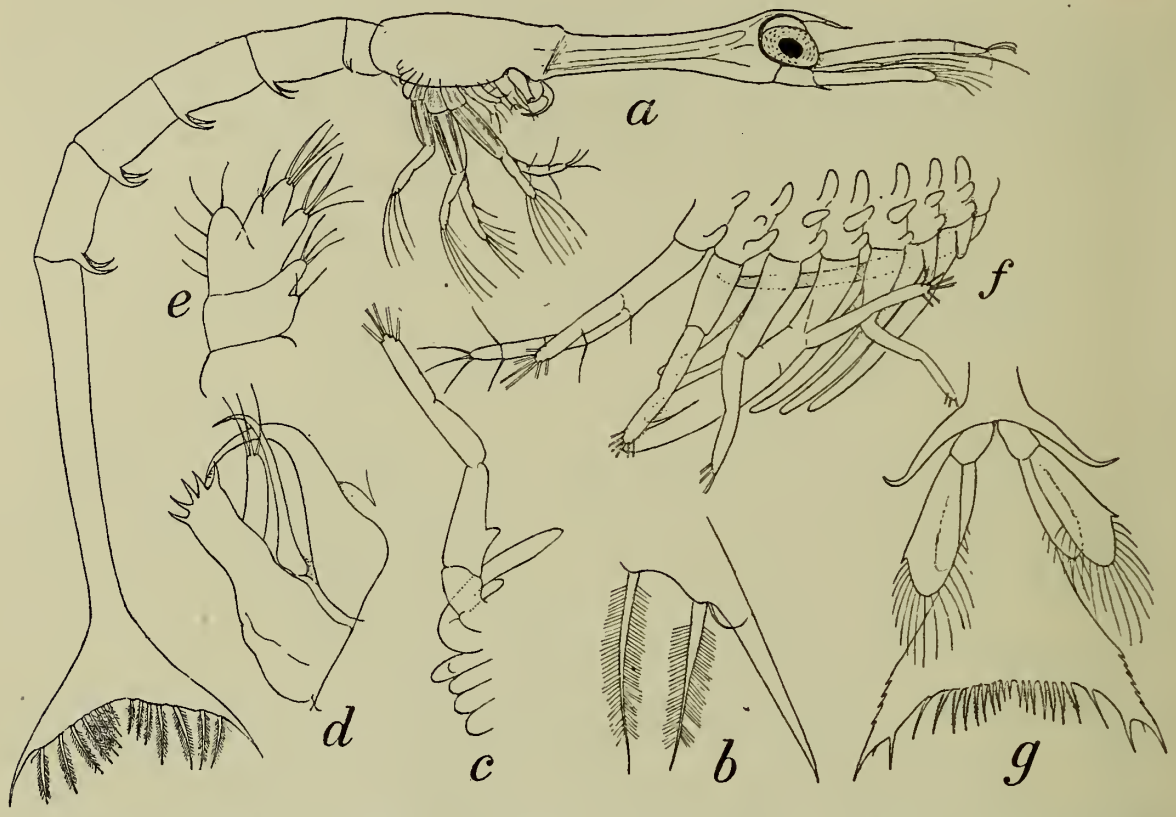

Fig. 61.—*Jaxea*, sp. *a*. Stage II. *b*. Stage II. Part of telson. *c*. Stage II. Third maxillipede and pereiopods. *d*. Stage II. Mandible and first maxilla of left side. Inner lacinia of maxilla hidden. *e*. Stage II. Second maxilla. *f*. Stage V. Pereiopods. *g*. Stage III. Telson.

is a small plate bearing five setae and entirely lacking the proximal prolongation so characteristic of this part in most Decapods. The endites are provided with relatively few spines.

The peduncle of the first antenna is still of one joint, but there is a small rudiment of the endopodite.

Stage III. Length, 10·7 mm.

Three specimens. This stage differs from the preceding in the following characters:

1. The endopodite of the first antenna exceeds the length of the exopodite, and the peduncle is two-jointed.

2. The endopodite of the second antenna exceeds the length of the scale. The basipodite bears in this and also in the preceding stages two spines on the ventral margin.
3. The first two pairs of pereiopods have natatory exopodites, though the endopodite is rudimentary. The third and fourth pairs have traces of exopodites.
4. The telson (fig. 61, *g*) is separated from the sixth somite, and has changed its form to a large, broadly triangular plate with a hollowed posterior margin bearing about twenty short spines. The outer margin is serrated in its distal third. The sixth somite bears two large spines.
5. The uropods have appeared, both branches being setiferous. The exopodite has a tooth on its outer margin. This tooth is not found in *J. nocturna*.
6. The pleopods are just visible.

This stage seems to correspond to the larva described by Bouvier as "Mysis imparfaite," but I should point out that his figures 5 and 11 (1914) have been transposed, fig. 11 referring to his larva of 9 mm. and fig. 5 to the form shown in fig. 9.

I cannot agree with Bouvier's interpretation of the thoracic appendages. He states that in the first two maxillipedes the endopodite is fused with the exopodite, while in the third pair and in the first two pereiopods it is free. If he were right then the epipodites would, in this species, be borne on the basipodite, which would be unique. The real fact is that the first two maxillipedes show the condition normal for all Decapod larvae, while in the succeeding appendages the endopodite has been shifted down the basipodite so that it arises from near its base. This shifting of the endopodite is a feature characteristic of the Anomura, and is found also in *Upogebia* and in *Stenopus*.

Stage IV. Length, 13·65 mm.

The changes which have taken place are as follows:

1. The endopodite of the second antenna is as long as the peduncle of the first pair.
2. The first leg has now a large endopodite ending in a distinct chela.
3. Legs 3 and 4 have long, simple, rod-like endopodites and rudimentary exopodites. In this respect the New Zealand form differs from *J. nocturna*, since the latter has a setiferous exopodite on the third leg.
4. The pleopods have appeared as biramous rudiments on somites 2 to 5.
5. There is an epipodite on the first maxillipede, but I have seen no trace of gills.

This stage seems to correspond to Bouvier's first Mysis of 10–11 mm. and to Cano's 1, *b*.

Stage V. Length, 16·6 mm.

This corresponds to Bouvier's "Mysis à chélipedes," fig. 9, and shows little change as compared with stage IV.

1. The endopodite of the second antenna extends to the end of the first pair.
2. The mouth-parts are apparently unchanged, except that the exopodite of the second maxilla has a proximal prolongation and has now the usual form of the scaphognathite.
3. The pereiopods are as before, except that the endopodites have increased in size and the chela of the first leg is much larger. The fifth leg is a long rod turned forwards and reaching to the base of the second maxillipede. The exopodites of the third and fourth legs remain rudimentary (fig. 6, *f*).
4. The gills and epipodites have appeared to the full number of the adult, except that the podobranchs are not separated from the epipodites.
5. The pleopods are somewhat longer.
6. The telson has practically the same form and armature, with eleven or twelve spines on each side of the posterior margin. But the outermost spine, which in stage IV approached the outer apex and was not articulated to the telson, has now moved even farther, in such a way that the apex appears bifurcate, with a minute spinule (corresponding to the outer hair of stage I) between the forks.

There is a radical difference between the telson of the New Zealand form and that of *J. nocturna* as figured by Cano (it is not described by Bouvier). Cano states that it is "trapezoidal" and armed in its median part with 6 + 6 spines, and it is figured with convex margin and rectangular corners. But Scott's figures and my own experience of the larva of *J. nocturna* taken at Plymouth, lead me to suppose that Cano's specimen was either abnormal or wrongly described.

Bouvier (1914) has endeavoured to summarize the available information with regard to the metamorphosis of *Jaxea*, and to complete it, but it is a little difficult entirely to reconcile his account with others, and he has not included the stages described by Cano. Brook's description is very brief, and only one stage is actually described and can be recognized, while neither Claus nor Cano attempt to separate a complete series of moults. I cannot altogether agree with Bouvier in his interpretation of the stages described by Brook and Claus, and the following seems more correctly to summarize the changes at the successive moults.

Stage I. Claus, 1884, p. 32, Taf. VIII, fig. 48.

Length, 3·5 mm. Two maxillipedes only developed. Small rudiments of succeeding appendages. No uropods.

Stage II. Claus, 1884, Taf. VIII, fig. 49.

Cano, 1891, Taf. IV, fig 1, *a*.

"Terra Nova" stage I. Length, 4·5 mm.

Two maxillipedes only. Large rudiments of maxillipede 3 and leg 1. No uropods.

Bouvier includes here Brook's larva, fig. 1, but describes it as having maxillipede 3 a simple rod, whereas Brook states that it is biramous.

Stage III. Brook, 1889, p. 42, fig. 1.

"Terra Nova" stage II. Length, 6 mm.

Three pairs of biramous maxillipedes. No uropods. Claus (1884, p. 32) alludes to a larva of 4·5 mm. with three maxillipedes, but states that on the abdomen "sind bereits Fächergliedmassen gesondert." It seems there must be some error here.

Bouvier's stage III is the larva of 7·5 mm. described by Claus, but he states that it has only the three pairs of maxillipedes, whereas Claus distinctly says that the first pereiopod is developed in that larva.

Stage IV. Claus, 1884, p. 32. Length, 7·5 mm. (not figured).

Brook, 1889, p. 422, fig. 2.

First pereiopods with functional exopodites. Uropods present. This stage is not represented in my series.

Stage V. Bouvier, 1914, p. 196, figs. 1 and 2. "Mysis imparfaite."

"Terra Nova" stage III. Length, 10·7 mm.

Pereiopods 1 and 2 with functional exopodites.

Brook does not attempt to give any detailed account of this or later stages.

Stage VI. Bouvier, 1914, p. 200, fig. 8. Length, 10–11 mm.

Cano, 1891, Taf. III, fig. 1, *b*.

"Terra Nova" stage IV. Length, 13·65 mm.

Pereiopod 3 with functional exopodite in *J. nocturna*.

Endopodite of this and following appendages long. Endopodite of leg 1 begins to be chelate. Pleopods appear.

Stage VII. Bouvier, 1914, p. 200, figs. 5 and 9.

Cano, Taf. III, fig. 1, *c*.

"Terra Nova" stage V. Length, 16·6 mm.

Leg 1 chelate, pleopods present.

Stage VIII. Claus, 1885, p. 63, Taf. V, fig. 45. Length, 15–16 mm.

This stage, which has only been seen by Claus, differs only in the greater development of the appendages and of the gills.

I give this summary of stages with some diffidence, since it is by no means certain that in all cases the whole series of stages will be passed through by any one larva, and the descriptions of the various authors are not always clear. But it is evident that *Jaxea* does have a much longer series of moults than is usual among the Reptantia, and it is therefore of some interest to place the facts on record.

Laomediidae, species (?) (fig. 62).

A single specimen of a larva in stage III from station 129 deserves notice for the reason that it has certain characters which enable it to be referred with some probability to the family Laomediidae. It is unfortunate that the specimen is too young to show the characters of the pereiopods or any trace of gills.

The rostrum is large, with a median ridge, and is not flattened or toothed as it is in the Axiidae and Callianassinae.

The eyes are large and almost devoid of pigment.

The second and third somites of the abdomen have a pair of large postero-ventral spines directed backwards.

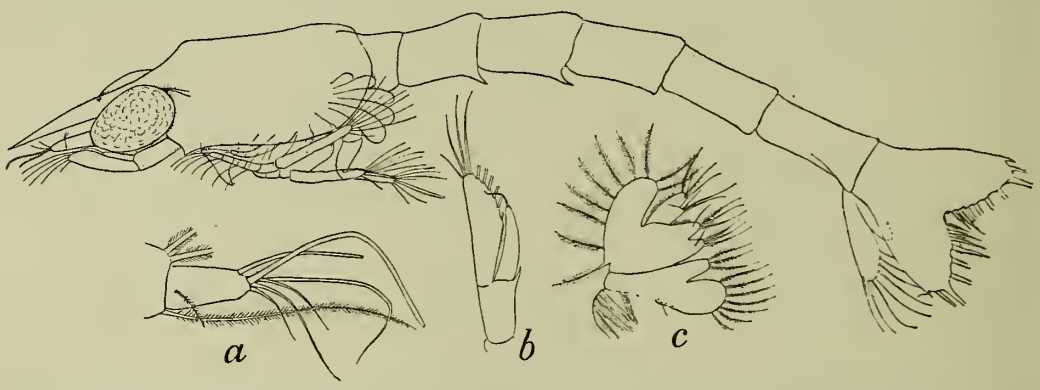

Fig. 62.—Laomediidae, sp. (?). Station 129. Stage III. *a*. First antenna. *b*. Second antenna. *c*. Second maxilla.

The telson is deeply cleft, with a tooth at its outer angle representing the first spine. The second is reduced to a hair, and the formula is 10 + 10, there being no median spine.

The mandibles are large, the outer angle somewhat produced, but not sickle-shaped as in *Jaxea*. The cutting edge is armed with a series of small points, but the exact form of the appendage cannot be illustrated owing to the distortion caused by the approach of the moult.

The third maxillipede has the endopodite reduced to a simple rod inserted near the base of the basipodite and scarcely reaching to the end of that segment.

In respect of the last character, of the form of the abdomen and of the telson, this larva agrees with *Jaxea* and *Naushonia*, and differs from all other Thalassinidea. Since the only other known genus of the family is *Laomedia*, it is possible that it belongs to that genus.

III. Callianassidae.

The larvae of the Upogebiinae are so distinct from those of the Callianassinae that they cannot be included in the same definition, and must be dealt with separately.

IIIa. Callianassinae.

The larval development of *Callianassa* has been described very fully by Sars, Cano, and Miss Webb, while Claus also has given figures of certain stages. Some uncertainty still prevails as to the species (and consequently the sub-genera) with which the different writers have dealt, but it seems clear that three species have been studied, so that probably the characters drawn from these descriptions may be regarded as valid for the whole genus.

If we were concerned only with the larvae of *Axius* and of *Callianassa* it would be easy to show strong differences between them and to lay down definite family characters; but, if I am right in attributing to the Axiidae the larvae described above, and to the Callianassinae those that follow, it is found that the differences practically disappear, and it is hardly possible to draw up any definition which will separate the two families. Both are characterized by the long, broad rostrum toothed along the sides which is so striking a feature of the genus Oodeopus, Bate, but some minor differences may be detected, as follows:

1. The Callianassinae seem always to have a very large spine on the second abdominal somite, while the succeeding segments are carinated and sometimes, as in *C. subterranea*, this carina is toothed; whereas in the Axiidae the segments are never carinated, are sometimes without dorsal spines, and when such spines are present those of somites 3 to 5 are not greatly smaller than that of the second.

2. Whereas it seems to be a rule that the Axiidae have exopodites on all the pereiopods, in the Callianassinae, as a rule at least, the last leg is uniramous.* But there are, I believe, exceptions to this rule, since there is a distinct exopodite on the fifth leg of the post-larval *Callianassa* described below.

3. In the Axiidae a pleopod is developed on the second abdominal somite, but in the Callianassinae pleopods seem to be generally absent from the first two somites. The only exception to this rule at present known is the larva described by Sars (under the name of *Calocaris macandreae*), in which four pairs of pleopods are figured.

4. The telson of the Axiidae is typically (*Axius*) very broad and bears more than eight spines on either side, whereas in the Callianassinae it is, in later stages, narrowed, more or less rectangular, and bears only 8 + 1 + 8 spines. On the other hand, the larva described above as possibly belonging to *Iconaxiopsis* has a telson indistinguishable from that of a Callianassid.

From this it appears that the characters *usually* holding good for the Callianassinae are as follows:

1. Rostrum broad, flat, toothed along edges.
2. Eyes oval.
3. Pleon somite 2 with a very large dorsal spine which is hollowed below.

* In one of the species of *Callianassa* described by Cano only legs 1 and 2 bear exopodites.

4. Pleon somites 3 to 5 with median carina and small spines.
5. Telson with median spine, broad and triangular in stage 1 and elongated, rectangular in last stages, with a formula 8 + 1 + 8.
6. Fifth pereiopod without exopodite.
7. Pleopods absent from somites 1 and 2.

Callianassinae.

Callianassa, sp.

At station 43 (fig. 63) a single and rather badly damaged specimen of a post-larval Callianassid was taken which, though it cannot be connected with any larva, deserves some description by reason of the extreme rarity of such specimens.

The specimen measures about 3·85 mm., of which the abdomen alone measures 2·5 mm., or more than twice the length of the cephalothorax.

The carapace is apparently without any grooves, and is prolonged into a rostrum of broad triangular shape which bends downwards over the eyes. The last somite of the thorax is quite distinct and not covered by the carapace. The abdominal somites have fairly well developed epimera which, except the sixth, are without setae.

The telson is rectangular, slightly longer than broad, with a median spine and a number of short setae and spinules. There is a group of setae on the dorsal surface near the base. The eyes are darkly pigmented.

The first antenna has a long peduncle with an otocyst and two flagella.

The second antenna has a vestigial scale without setae. The flagellum is broken off.

The mandible has a simple rounded molar surface and a small unjointed palp curving inwards towards it.

In the first maxilla the basal joint has a small papilla on its outer end which may represent the exite of certain Decapods, e. g. *Upogebia*. The endopodite or palp is rather large and two-jointed.

The second maxilla has four distinct inner lobes. The endopodite is rather large, indistinctly jointed, and with setae. The exopodite is very large.

The first maxillipede has the basal joint almost devoid of setae, but bearing on its outer face a large Y-shaped epipodite. A minute projection from the epipodite may represent the podobranch. The second joint has an enormously long lacinia which projects greatly beyond the minute endopodite. The exopodite is a large plate of irregular form without a terminal flagellum and with scattered setae.

The second maxillipede has the coxopodite and basipodite distinctly separated, but the two basal joints of the endopodite are fused. The exopodite is not longer than the two fused joints, rather broad, and without a flagellum.

The third maxillipede is a very large and conspicuous appendage. The exopodite is reduced to a minute papilla. Ischium and merus are fused. The propodite is

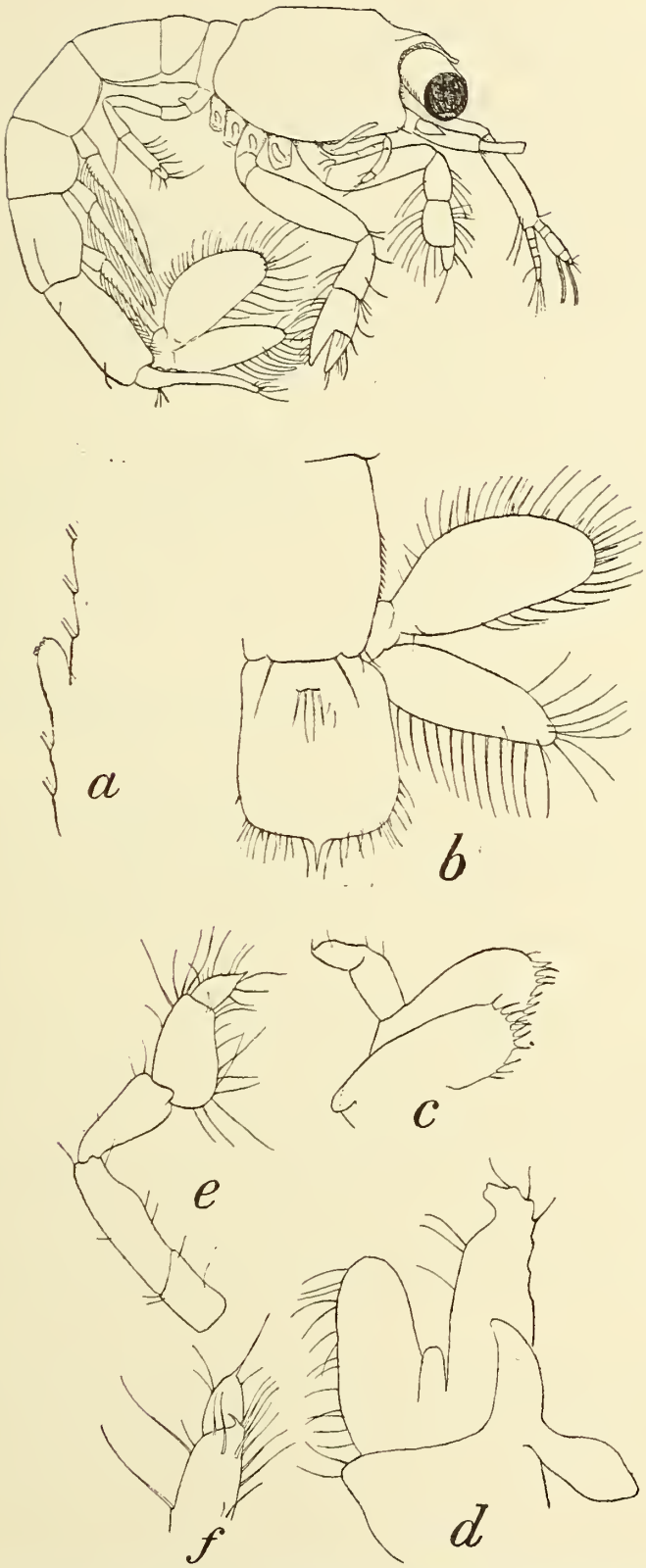

Fig. 63.—*Callianassa*, sp., post-larval. Station 43. *a*. Edge of pleopod showing retinaculum. *b*. Telson and uropods. *c*. First maxilla *d*. First maxillipede. *e*. Third (?) leg. *f*. End of fifth leg.

expanded and bears a fringe of long setae. The dactylopodite is small and seated on the anterior part of the propodite.

All the legs, including the fifth pair, bear minute vestiges of exopodites. The first and fourth legs are broken off and lost.

Leg 2 is large and chelate.

Leg 3 is broken off, but a loose leg found in the bottle is probably one of the missing appendages. In this leg the ischium and merus are separate. The propodite is greatly expanded proximally, but narrowed distally to the same width as the dactylus.

Leg 5 is small. The propodite has a minute claw at its distal end, and a number of long setae; the dactylus is simple.

There are no pleopods on the first two abdominal somites. On the remaining somites they are very long, with narrow, profusely setiferous rami of which the inner is shorter than the outer. The endopodite of each pleopod bears an appendix interna.

The uropods are large, the exopodite broader than the endopodite, and both without sutures.

The gills are so small as to be distinguished with great difficulty, but I believe the formula below to be correct.

	Ep.	Arth.	Pleur.
Mxp. 1	1	—	
Mxp. 2	1	?	
Mxp. 3	—	2	
Leg 1	—	2	
Leg 2	—	2	
Leg 3	—	2	
Leg 4	—	2	
Leg 5	—	—	

A small papilla at the base of the second maxillipede probably represents an arthrobranch, but is somewhat doubtful.

That this specimen belongs to the Callianassinae is clear from its general form, its gill formula, and other details of structure, but it is impossible to identify it with any certainty with any described genus. It differs from any known genus in the absence of the *linea thalassinica*, the shape of the third maxillipede, and in the shape of the eye.

If we assume that it belongs to the Callianassinae *Callianidea* and *Glypturus* are excluded by the gill formula and the form of telson and uropods.

Within the genus *Callianassa* which alone remains, the sub-genus *Scallasis* only has rounded eyes, but, though the agreement in other respects is fairly close, the form of the third maxillipede is very distinct. On the other hand it agrees still less with the remaining sub-genera both with regard to the form of the eyes and of the third maxillipedes. It is naturally impossible to say whether either of these

structures would change materially with later growth, but I do not think it at all probable that they would.

I must therefore leave the identification uncertain, but place the animal provisionally in the genus *Callianassa* in its wider sense.

Callianassa, species II (fig. 64).

This larva, taken at station 40, measures 5·1 mm. and closely resembles *C. subterranea*.

The rostrum is of great size, and toothed along both margins, and there is a minute rudiment of the dorsal organ behind it. The carapace has a pair of sub-orbital

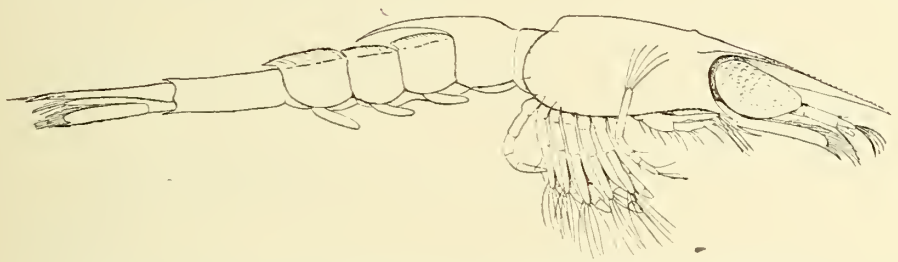

Fig. 64.—*Callianassa*, species II. Last larval stage. Station 40.

spines and is denticulate along the anterior part of its ventral margin. The second abdominal somite bears a very large spine which reaches nearly to the end of the fourth somite. Somites 3 and 5 have each a pronounced dorsal carina which has a "fluted" appearance and is serrated along its margin.

The sixth somite has a small dorsal, a pair of ventro-lateral, and a median ventral spine.

The telson is longer than the uropods and rather narrow, its greatest width scarcely more than half its length. The median spine is very small, and there are eight spines on either side, the outermost three being very small and two of them seated on the outer margin. The fourth spine is greatly the largest.

The antennal scale has a long outer terminal spine and there is a strong spine on the basipodite.

The first four pairs of pereiopods bear exopodites, each with five setae. The endopodites of the first two pairs are sub-chelate.

Leg 5 is well developed and uniramous.

There are three pairs of rudimentary biramous pleopods on somites 3, 4, and 5.

The uropods are fully developed, each branch bearing setae, and there is a long terminal spine on the exopodite.

The eye is large, of a peculiar oval shape, but apparently without any black pigment.

The gills are scarcely developed, and there appears to be only a single gill in the position of an arthrobranch on the first four pereiopods.

This larva closely resembles *Oodeopus serratus*, Bate (1888, p. 877, Pl. CXLII, figs. 2, 3), from the New Hebrides, but differs in the structure of the telson and absence of an exopodite on the fifth leg. The similarity to the larva of *Callianassa subterranea*

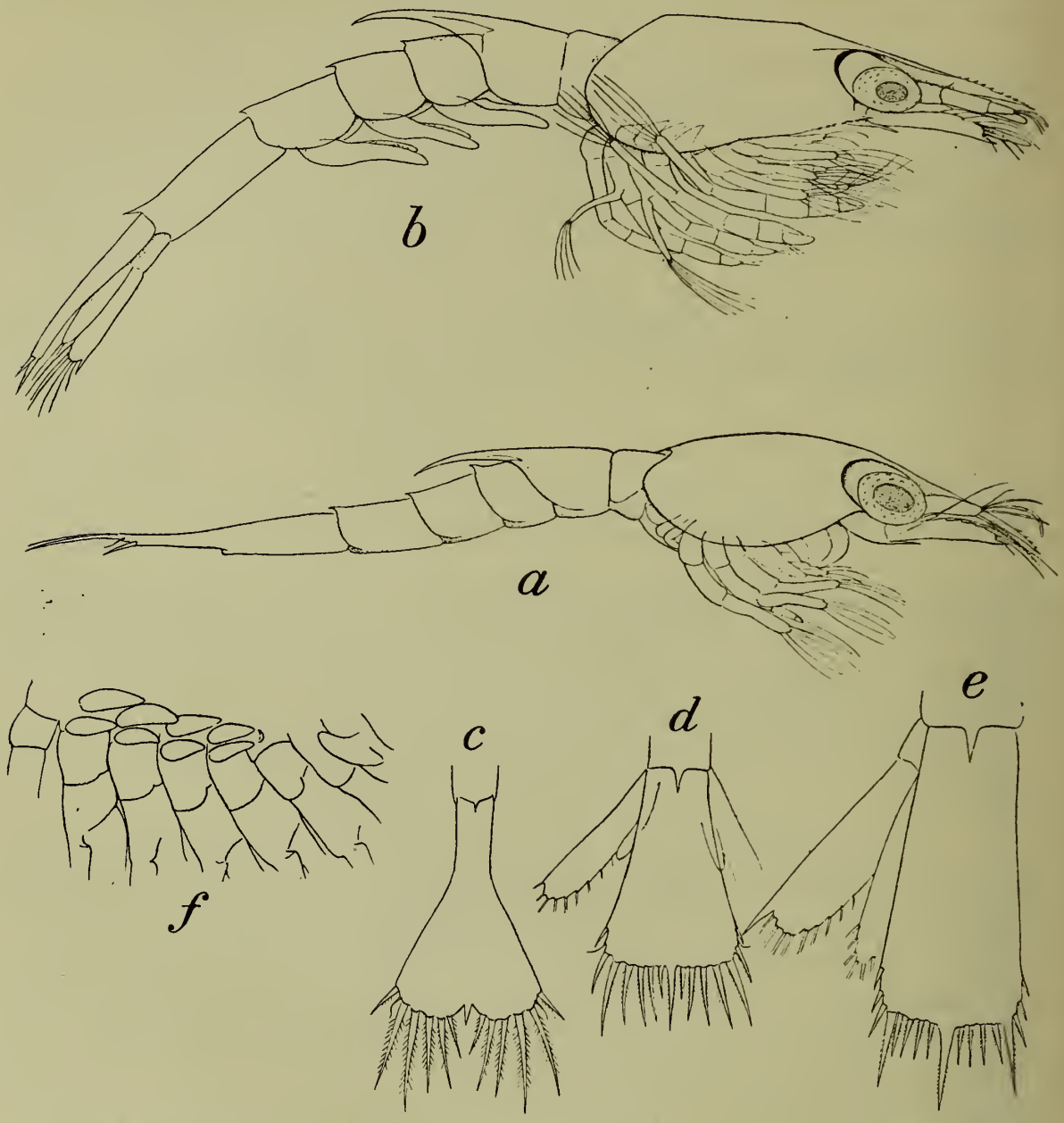

Fig. 65.—*Callianassa*, species III. Station 148. *a*. Stage I. *b*. Stage V. *c*. Stage I. Telson. *d*. Stage III. Telson. *e*. Stage IV. Telson. *f*. Stage V. Pereiopods.

is also very striking, and there can be no doubt that it belongs to a species of that genus.

Callianassa, species III (fig. 65).

Of this species, which was taken at station 148 there are larvae representing five stages.

Stage I. Length, 1·64 mm. (fig. 65, *a*).

The rostrum is very long, slightly down-bent, and not flattened, but bears a few small denticles near the end.

The ventral margin of the carapace is smooth and there are neither supra- nor sub-orbital spines. A sub-orbital spine appears in stage III.

The second abdominal somite bears a long hollowed spine reaching to the end of the fourth somite, while somites 3, 4, and 5 have very small dorsal spines.

The telson is broad and triangular, with a spine-formula of 7 + 1 + 7 (see fig. 65, *c*).

The endopodite of the second antenna bears a single long seta.

The three pairs of maxillipedes are developed with exopodites bearing 1, 4, and 5 setae respectively.

The pereiopods are not developed, though the first two pairs may be distinguished through the skin.

Stage II. Length, 3·67 mm.

This stage differs only from the first in that the first two pairs of pereiopods are present as free rudiments.

The telson is unchanged except for the presence of an additional spine.

Stage III. Length, 4·45 mm.

The endopodite of the second antenna is now a short rod without a seta, and the endopodite of the first antenna has appeared.

There are two pairs of biramous legs, and very small rudiments of the succeeding pairs.

There are no pleopods, but the uropods are present, the endopodite about half as long as the exopodite and with one terminal seta. The telson has changed its form, being much narrower in proportion to its width (fig. 65, *d*). The median spine has increased in length, and the proportional length of the spines has changed. The second seta is still represented by a minute hair.

Stage IV. Length, 4·9 mm.

This stage differs from the next (stage V) only in the smaller size of the pereiopods and pleopods, and the proportion of width to length in the telson—the width being more than half the length.

Stage V. Length, 6 mm. (fig. 65, *b*).

This is evidently the last stage before metamorphosis. The endopodite and exopodite of the first antenna are still very small and one-jointed, but the endopodite of the second antenna exceeds the length of the scale and shows joints beneath the skin.

All the pereiopods are fully developed, each, except the last, having setose exopodites. The first leg is much the largest, and is chelate, as is also the second leg.

There is a median ventral spine at the end of the sixth abdominal somite.

The pleopods on somites 3, 4, and 5 are large and biramous.

The telson is narrow, the width being about equal to half the length. The median spine is very long.

The fourth spine is the largest, and the outer three are small, sub-equal, and placed on the outer margin.

The uropods are shorter than the telson, both branchs setose, and the exopodite with a terminal spine (fig. 65, *e*).

Gills are present at this stage. There is a large epipodite on the first maxillipede and a pair of arthrobranchs on legs 1 to 4, but none on leg 5 or on the third maxillipede (fig. 65, *f*).

IIIb. Upogebiinae.

The metamorphosis of the allied genera *Gebiopsis* and *Upogebia* is completely known, though there remains a little uncertainty as to the exact species dealt with by the authors who have described the larvae. Sars (1884) described the development of a species named by him *Gebia littoralis* Risso, but certainly belonging to the genus *Gebiopsis* and therefore not to *Upogebia littoralis*. Cano in 1891 followed the metamorphosis of *Upogebia littoralis*, while Miss Webb (1919) has given a very full account of the larvae of both *Gebiopsis deltaura* and *Upogebia stellata*, together with a comparison of these larvae with the description previously given by Sars. There can be no doubt, on comparing Sars's and Cano's descriptions, that the former's species was not *Upogebia littoralis*, and Miss Webb's conclusion is that the larvae may have belonged to a Norwegian species hitherto undescribed. On the other hand, Sars's figures show quite clearly that he was dealing with a species of *Gebiopsis*, and the differences between his description and that of Miss Webb of the larval and post-larval stages of *Gebiopsis deltaura* seem to be so small that I have no doubt that the Norwegian larvae belonged to *G. deltaura*, which is known to occur on the coast of Denmark if not of Norway.*

The following characters may be regarded as distinguishing the larvae of the Upogebiinae:

1. Rostrum very small, not flattened horizontally.
2. Abdominal somites without dorsal or lateral spines.
3. Telson with reduced second seta, and, in later stages, with small median spine. Fourth spine the largest in later stages.
4. Mandible without palp.
5. Two pairs of biramous maxillipedes present on hatching. Legs 1 to 3 develop exopodites.
6. Pleopods absent from abdominal somite 1 only.
7. Endopodite of third maxillipede rudimentary and springing from base of basipodite.

* Stephensen (1910) has given Sars's *G. littoralis* as a synonym of *Upogebia stellata*. With this I do not agree.

Upogebia danai, Miers (figs. 66 and 67).

A number of larvae, apparently belonging to the same species of *Upogebia*, were taken by the "Terra Nova" at stations 130, 133, 135, and 148. The material contains larvae in every stage and fortunately includes a single specimen in the first post-larval form, so that it is possible to identify them with certainty as belonging to the genus *Upogebia*, and with reasonable probability to the species *U. danai*.

Miss Webb's account of the development of *G. deltaura* is so complete that it is unnecessary to describe the structure of the New Zealand form in detail, but it is of some interest to show that the course of development is almost precisely the same in the two cases.

Four larval stages may be distinguished as follows:

Stage I. Length, 3·15–3·2 mm.

Of this stage, which I believe to be the first-hatched larva, there are several specimens, and they differ from the European form only in size. The first and second maxillipedes bear setose exopodites, and the remaining thoracic appendages are present as rather large rudiments. Minute knobs on the ventral surface of the abdominal somites represent the pleopods. The telson is precisely the same as that of *G. deltaura*. I should point out that Miss Webb has omitted from her figure (Pl. III, fig. 9) the very small hair which represents the second seta of the telson. This reduced seta is of great systematic importance and is undoubtedly present in *G. deltaura*, *U. stellata*, and *U. littoralis*, as it is also in *U. danai*. It is, however, exceedingly small and inserted on the ventral surface, so that it is often invisible from above. It has been figured, and its importance appreciated, by P. Mayer (1877), but it was not observed by G. O. Sars.

Stage II. Length, 3·7–4·15 mm.

Miss Webb found a certain variation in respect of the exopodites among the individuals of this and later stages, such that she was able to divide them into two series, Class A and Class B, but I do not find any such differences among the specimens at my disposal. These specimens do vary to some extent in the degree of development of the pereiopods and pleopods, but it is probable that these differences are due to growth of the soft functionless appendages between the moults. The endopodite of the second antenna is now nearly as long as the scale and usually bears only two setae, but in some cases the third is also retained, while in others all are lost. The three pairs of maxillipedes and the first three pairs of legs each bear a setiferous exopodite, the numbers of setae on them being 6, 7, 7, 7, 6, 6.

The endopodites of the five pairs of pereiopods are large, curving forwards, but they are not as a rule packed tight under the sternum as is the case in *G. deltaura*. In the latter only the exopodite of the first pair of legs is developed and functional.

The pleopods are now present, and may be so large as to overlap each other.

The telson is of the same shape as before, but has a median unpaired spine and

an additional pair of setae, the formula being 8 + 1 + 8. The outer hair is so small that it can only be seen with difficulty (fig. 66, *f*).

In two specimens which were ready to moult to stage III the pereiopods and pleopods are considerably larger, and the uropods can be distinctly seen beneath the cuticle.

The endopodite of the rudimentary uropods is small and bent forwards, instead of lying parallel with the exopodite.

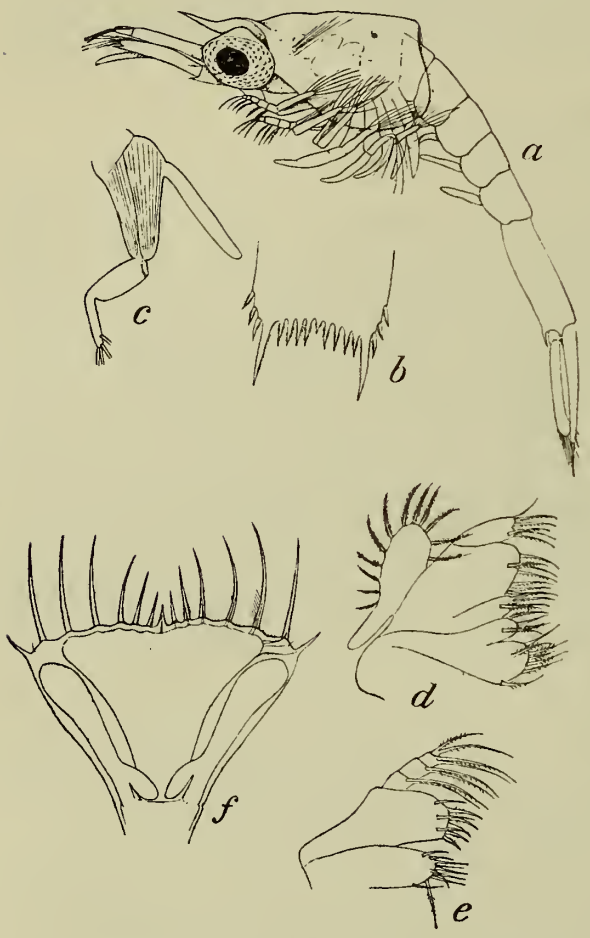

Fig. 66.—*Upogebia danai*. Station 133. *a*. Stage IV. *b*. Telson. *c*. Third maxillipede. *d*. Second maxilla. *e*. First maxilla. *f*. Stage II. Telson.

Stage III. Length, 4·55–4·6 mm.

I have had eleven specimens of this stage for examination, and find among them little or no variation in the degree of development of the appendages.

The endopodite of the second antenna is longer than the scale, and without setae.

The pereiopods are very large, the first two legs reaching forwards beyond the mouth. The first pair shows no trace of a chela.

The pleopods are but little larger than in stage II, and are uniramous.

The telson and uropods are as figured for *G. deltaura* by Miss Webb (Pl. IV, fig. 10), the inner ramus being small and without setae, and the telson narrower than in the preceding stage and with shorter setae but the same seta-formula.

The gills are not yet developed, but may be faintly detected under the skin; each of the maxillipedes, however, bears a minute rudiment of an epipodite.

As Miss Webb has shown to be the case in *G. deltaura*, this stage may, and apparently usually does, moult directly to the post-larval form. This is quite definitely proved by two specimens which are about to moult, and show distinctly that at the moult the antenna would develop a long segmented flagellum, while the scale would be reduced to a small vestige.

Stage IV. Length, 4·85 mm. (fig. 66, *a–e*).

One specimen only of this stage was taken. This specimen differs only from stage III in the narrower form of the telson and the greater development of the uropods, the inner branch of which now bears a number of setae, but I propose to

describe this stage in some detail for the purpose of comparison with the European species, and also with the larvae of other Decapods here dealt with.

In general form it does not differ in any way from *G. deltaura* of corresponding age, but there are certain small differences in the appendages which should be mentioned.

The antennae and mandibles have no special features.

The first maxilla differs from that of *G. deltaura* in the form of the two basal segments, which unite to form a conspicuous hump at their outer edge (fig. 66, *e*). The endopodite is more slender than in *G. deltaura* as figured by Miss Webb, but agrees exactly with Sars's figure. The second maxilla (fig. 66, *d*) is remarkable for the complete absence of setae from the proximal part of the exopodite, a feature specially characteristic of the Paguridae, while the total number of setae borne by the distal part is only twelve. Both Sars and Miss Webb show setae covering the whole margin of the exopodite except the proximal inner margin. The number of setae apparently differs in *G. deltaura* and *U. stellata* (eighteen and fourteen according to Miss Webb), while Sars figures twenty-one. There is, therefore, in the European species a tendency to the loss of setae on the proximal part which is complete in *U. danai*. I am not aware of any Decapods, except *Upogebia*, *Gebiopsis*, and the Paguridae, in which the second maxilla has this proximal lobe bare or nearly so.

The first maxillipede of *U. danai* agrees with that of *G. deltaura*, having a four-jointed endopodite, of which the second joint bears a long ciliated seta on its outer margin, and an exopodite shorter than the endopodite and bearing six terminal setae. These setae are not arranged symmetrically. Four of them are placed in pairs at the end, but the other two are both on the anterior margin. This asymmetrical disposition of these setae in this and the other thoracic appendages is frequently found among the Anomura and Thalassinidea, but never, so far as I know, among the Natantia.*

The second maxillipede has a four-jointed endopodite, and its exopodite bears seven setae. The endopodite springs from a point not quite at the end of the basipodite, so that the exopodite appears as if elevated on an extension of the basipodite.

The third maxillipede has the endopodite in the form of a long slender unjointed rod, springing from quite near the base of the basipodite, and is considerably more slender than in *G. deltaura*. This peculiar position of the endopodite, which is repeated in the succeeding limbs, is found also in *Jaxea*, most Anomura, and in *Stenopus* (see p. 139).

In *U. stellata* and *G. deltaura* the endopodite of leg 1 is very large and thick, and shows a distinct incipient chela, but in *U. danai* it is much more slender and has no trace of a chela.

* There is sometimes a certain amount of asymmetry in the exopodite of the first maxillipede in Caridea.

Legs 2 and 3 do not differ noticeably from *G. deltaura*, but the exopodites bear eight and six setae respectively, instead of seven in each as given by Miss Webb.

The last two pairs of legs are uniramous and unjointed rods which hang nearly straight downwards instead of being curved forwards as in the European species.

There are four pairs of pleopods, the first somite of the abdomen having no trace of appendages.

Stage V. (Fig. 67.)

A specimen evidently in the first post-larval stage was taken in the plankton at

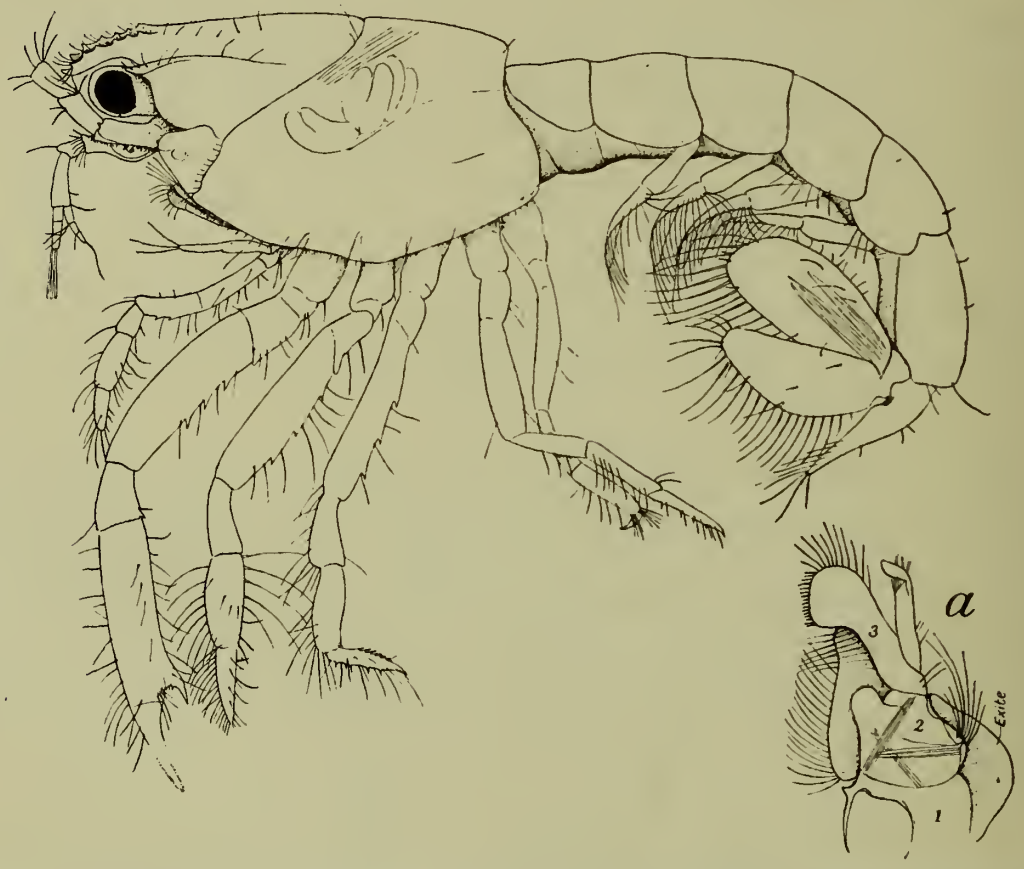

Fig. 67.—*Upogebia danai.* Post-larval. Station 135. *a.* First maxilla. *Upogebia stellata* adult.

station 135. This specimen measures 4·5 mm., or slightly less than the larva just described, but the difference in size is quite compatible with specific identity of the two individuals. Not only is there considerable individual variation in size among Decapod larvae, but also a certain amount of shortening of the body seems commonly to take place at the last larval moult. Miss Webb gives the size of the larva in Stage IV as "just over 4 mm.," while the first post-larval stage moulted therefrom was only 3·9 mm. Sars gives the size of the last larva and first post-larval form as identical (5 mm.), while in *Naushonia* Thompson (1903) found a reduction of length from 10 to 6 mm.

The animal has now all the characters of the genus *Upogebia* as distinct from *Gebiopsis*.

The rostrum, which projects considerably beyond the eyes, is a concave, down-turned extension of the carapace with six large teeth along each margin.

On either side of the rostrum is a conspicuous supra-orbital tooth overhanging the eye and continued backwards as a ridge bearing a few hairs. The carapace is soft, and I have not detected any trace of a "Linea thalassinica" such as is present in the adult *Upogebia*, though there is a distinct transverse cephalic groove which runs forwards and joins a line running back from the incision in the shell below the eye. It is continued downwards to the margin of the carapace, bearing here a line of short hairs and cutting off a triangular area between it and the above-mentioned incision.

The first antenna has a conspicuous auditory sac in the basal joint, and the second joint of the peduncle is very short. There are two short flagella, each of three joints only.

In the second antenna the second joint of the peduncle bears a vestige of the scale in the form of a thin plate with an apical tooth, which projects very slightly beyond the end of the joint and is very faintly jointed off from it. The degree to which the scale is retained in the adult seems to vary a good deal with the species. It is conspicuous in *U. stellata*, and also in *U. littoralis*, but it is altogether absent from a specimen of *G. deltaura* examined by me.

The mandibles and maxillae have the form of the adult.

The first maxilla (fig. 67, *a*) is of very remarkable form in this genus, and is distinctly three-jointed. Viewed from behind it appears two-jointed, the basal joint having a very large outer plate or exite (see Boas, 1880, Pl. III, fig. 106) corresponding to the similar plate in Euphausids. Viewed from in front (fig. 68, *a*) it is seen to be very distinctly three-jointed, and it is a little uncertain whether this exite springs from the first or second joint. I assume that it belongs to the first, and that the second joint is here unusually well developed and bears on its outer side a tuft of long hairs.

The second maxilla has a distinctly two-jointed stem, each joint bearing two well-developed endites. The endopodite is a long slender rod hidden by the distal endite. The scaphognathite bears setae along its whole margin except upon the proximal inner face.

The first maxillipede differs in detail from that of *U. littoralis* as figured by Boas, the distal lacinia being rather pear-shaped and the exopodite bearing very few setae; but the latter is probably a character of immaturity. The endopodite is well-developed but not segmented. There was no trace of an epipodite.

The second maxillipede likewise bears no epipodite. The endopodite is distinctly five-jointed, and the exopodite long and fringed with short stiff setae along its outer margin.

The third maxillipede bears one arthrobranch in place of the pair that is usual

in the adult, and a rudiment of the epipodite. The endopodite is distinctly five-jointed, but the exopodite is very small and bears only three terminal setae. The first joint of the endopodite is expanded on its inner face into a thin, strongly toothed plate.

The first pair of legs are very long, and scarcely sub-chelate, the propodus being produced into a spine which barely reaches beyond the base of the dactylus. There are three or four small teeth on the inner edge of the propodal process. The merus has three teeth on its inner face instead of five or six as described by Chilton in the adult. The merus of the second and third legs each bears three teeth. The dactylus of the third leg has a row of small teeth on the anterior face and a serrated posterior margin.

The pleopods, of which there are only four pairs, have the endopodite very small, but bearing numerous long setae. The posterior margin of the telson is simply rounded and profusely setiferous.

The gill formula is as follows :

	Ep.	Arth.
Mxp. 3 *	rud.	1
Leg 1	—	2
Leg 2	—	2
Leg 3	—	2
Leg 4	—	2
Leg 5	—	—

thus agreeing with the formula as given (e.g. by Huxley) for the genus, with the exception of the presence of one rudimentary epipodite and only one arthrobranch on the third maxillipede. Probably a second arthrobranch would develop later, since Sars found only one gill on this limb in the post-larval stage of *G. deltaura*. He shows, however, an additional rudimentary epipodite on the second maxillipede.

Borradaile (1903, p. 543) draws special attention to the presence of an arthrobranch on the fifth leg of *U. capensis* described by Stebbing, with the observation that the extra gill may make it necessary to found a new sub-genus to include species having this character. I have dissected a specimen of *U. stellata* and find a rudimentary epipodite on the third maxillipede and also a well-developed gill on the fifth leg, whereas neither are present on a specimen of *G. deltaura*. Huxley does not state which species he examined, while the formula given by Claus is for *U. littoralis*. I am not aware of any other independent observations on the gill formula of *Upogebia*, but it seems likely that a gill may be found on the fifth leg more frequently than has been supposed. Its presence or absence would hardly justify the foundation of a separate sub-genus.

There are a few differences between the post-larval stage as above described and the first post-larval stage of *G. deltaura* as described by Miss Webb and Sars which

* The presence of rudimentary epipodites on maxillipedes 1 and 2 in the larva has already been mentioned. Probably they are present also in the post-larval stage, but could not be seen.

are worth mentioning. In *G. deltaura* the endopodite of the first maxillipede and the exopodite of the second and third maxillipedes are altogether without setae, whereas in *U. danai* both are fairly well developed and setiferous. Further, the terminal joint of the second maxillipede and the end of the exopodite of the first maxillipede are likewise without setae in *G. deltaura*, but are provided with them in *U. danai*. This temporary loss of setae in appendages or parts of appendages is referred to above, p. 71.

It is hardly to be expected that all the specific characters of the adult should be developed in the first post-larval stage, but I have compared my specimen with the description of *U. danai* given by Chilton (1907), and the agreement seems to be remarkably exact. The only serious discrepancy is in the length of the carpus of the first leg which, according to Chilton, should be about half as long as the merus. In this specimen it is almost exactly one-third of it. The propodus also lacks the small teeth mentioned by Chilton. The shortness of the carpus is probably a juvenile character, since it is particularly this joint which elongates greatly in post-larval life in Palaemonidae, and it may be so in other Decapods. At present we know practically nothing about post-larval growth and changes in any species.

Thalassinidea, *incertae sedis* (fig. 68).

At stations 40 and 43 some larvae were taken which it is impossible to refer to any family, since they combine a general resemblance to the Thalassinidea with certain characters of the Anomura.

Specimens have been seen in two stages, but later stages which would have given better indications of affinity are absent.

The earliest stage measures 2·23 mm. (fig. 68).

The rostrum is long, pointed, but widening out at its base to cover the eyes.

The carapace is produced into a small sub-ocular spine, and has two or three spines on its anterior ventral margin and a pair of spines at its posterior ventral angle.

The abdominal somites have no dorsal spines, but the fifth somite has a lateral pair.

The telson, which is not separated from the sixth somite, is narrow, widening but slightly towards its end. There is no median spine, and the spine formula is 7 + 7. The second spine is the smallest, but it is not reduced so much as is usual in the Thalassinidea and Anomura.

The first antenna consists of an unjointed stem bearing a terminal seta and a small exopodite.

In the second antenna the peduncle bears a very large spine and a long tapering spinous endopodite. In the Thalassinidea the endopodite in the first stage always bears two or three setae. The scale is large and broad, with a large terminal spine.

The first maxilla is of the usual form, the endopodite of two joints.

The second maxilla has four distinct lobes, a short thick endopodite with two lobes, and an exopodite with four setae.

There are three pairs of biramous maxillipedes. The setae, of which there are five on each exopodite, are arranged in a rather peculiar manner (see fig. 68, *d*).

The terminal joint of the second and third maxillipedes bears a spine and two (mxp. 2) or three (mxp. 3) setae.

The second stage observed differs little from the first. One pair of legs is developed with setiferous exopodite and a small endopodite, while leg 2 is represented by a small hump.

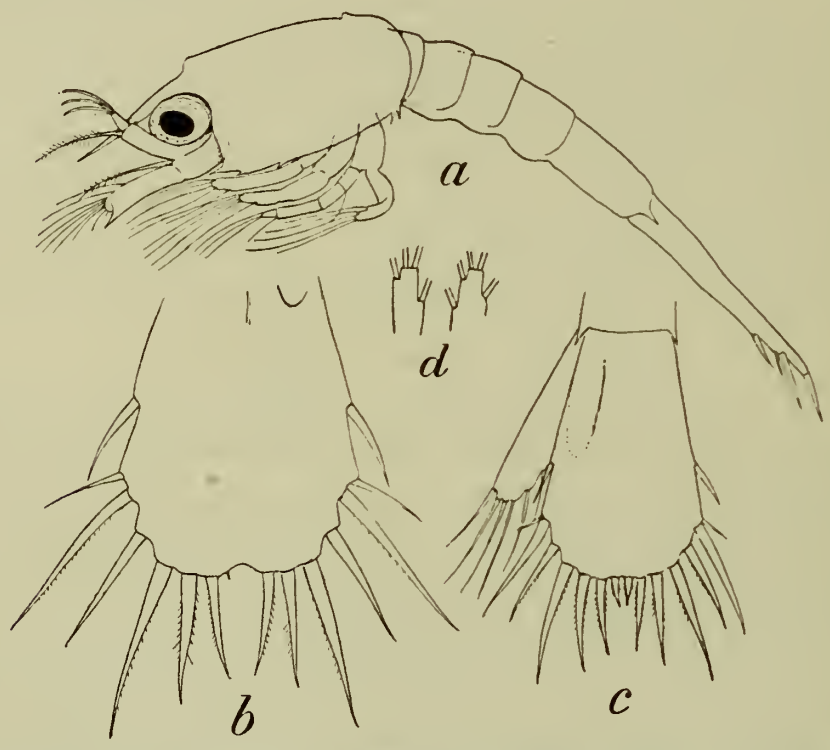

Fig. 68.—*Thalassinidea*, incertae sedis. *a*. Stage I. *b*. Stage I. Telson. *c*. Stage III. Telson. *d*. Arrangement of setae on exopodite of maxillipedes.

There are no pleopods, but the uropods are present, the endopodite without setae (fig. 68, *c*).

The telson is of the same shape, but with eight setae on either side.

THE SYSTEMATIC POSITION OF THE THALASSINIDEA.

The Thalassinidea have been recognized as holding a position somewhat intermediate between the Homaridea and the Anomura, but have generally been regarded as more nearly related to the former. Ortmann (1890–1) considered them to be specialized Homaridea, though Borradaile, followed by Calman (1909), included the Thalassinidea as a section of the Anomura. Bouvier (1917) has reverted to the older view that they belong more naturally to the "Macrura Reptantia," pointing out the very

close resemblance of the Axiidae to the Homaridea, and particularly to such forms as *Thaumastocheles*.

The evidence as to the relationships of this puzzling group supplied by the larvae is rather conflicting. It is not easy to find in the unspecialized larvae of Decapods many well-defined characters which can be used as evidence of affinity, and the development of the Palinura and Homaridea is either so abbreviated or so peculiar that comparison is difficult.

Such evidence as there is may be stated in this way:

Homarine characters of Thalassinid larvae.

1. Presence of exopodites on three or more legs.
2. Median spine in the telson of all but Laomediidae.
3. Presence usually of dorsal spines on the abdomen.

Anomuran characters.

1. Reduced second seta in the telson. The fourth spine the largest.
2. Rudimentary endopodite on the third maxillipede seated at the base of the basipodite in *Jaxea*, *Naushonia*, and *Upogebia*.
3. Undifferentiated endopodites of the pereiopods.
4. Epimera usually reduced.

The early appearance of the mandible palp is a character of the Reptantia in general as distinguished from the Caridea (with the exception of the Hoplophoridae).

It seems that, on the whole, the balance of resemblance is in favour of the Anomura, since they have the greater number of characters in common. If the Laomediidae and *Upogebia* are removed the position is a good deal changed, and the only Anomuran character of real significance remaining is the reduction of the second seta in the telson, and the preponderance of the fourth spine. But the Homarine telson is armed with an "indefinite" number of small spines, among which the reduction of one would hardly be noticeable, neither is it to be expected in these more primitive forms.

The Laomediidae, on the other hand, by the form of their telson and the peculiar position of the endopodite of the third maxillipede and biramous legs, are most strikingly Anomuran, and are also very distinct in other respects from the larvae of the other Thalassinidea. As has already been pointed out, the larva of *Stenopus* closely resembles that of the Laomediidae in just these characters, which cannot be disregarded as of small significance.

It is tempting to suggest that the Thalassinidea should be divided into a Homarine series including the Axiidae and Callianassinae, and an Anomurous section embracing the Laomediidae.* If this is done a difficulty arises in connexion with the Upogebiinae, since the larvae which are known have little or

* Since no larva is known of any species belonging to the Thalassinidae this family cannot be considered.

no resemblance to those of the Callianassinae but show such strong affinity to those of *Jaxea* and *Naushonia* that they would have to be included in the Anomurous section.

Such a splitting of the family Callianassidae may be entirely unwarranted by adult structure, and I am not in a position to defend it by a study of the whole group. At the same time it does not seem to me that the family is necessarily a natural one. The only important character uniting the two subfamilies and separating them from the remaining Thalassinidea is the reduction of the gills.

Boas (1880, p. 187) has already pointed out certain characters in which *Callianassa* agrees with the Axiidae and is distinct from *Gebia* and *Thalassina*. Perhaps one of the most important characters in this connexion is the *appendix interna*, which is present only in the Axiidae and Callianassinae. It is true that it is also absent from the Homaridea, but a statement that the Axiidae and Callianassinae form together a Homarine series does not necessarily imply direct descent from existing Homarids.

Another character which may be mentioned here is the exite on the coxopodite of the first maxilla. This exite is very large in *Upogebia* and is also developed in *Jaxea*, but is not present in *Callianassa* or in *Axius*.

I am aware that I am trespassing beyond my province in attempting to deal with adult anatomy, but it seems to me that if the larval characters alone are considered it is certainly necessary to draw the conclusion that the Thalassinidea are not a homogeneous group. This conclusion may be stated thus:

1. The Thalassinidea larvae fall into two series—
   (*a*) A Homarine series including the Axiidae and the Callianassinae.
   (*b*) An Anomuran series including the Laomediidae and Upogebiinae.
2. The Stenopidea are Reptantia allied to the Anomuran section of the Thalassinidea.

With regard to the second proposition it may be objected that the Stenopidea with a well-developed antennal scale cannot be descended from ancestors which have none or only a vestige of it, but there is not, I think, a great deal of force in this objection. The adult is only the last phase in the individual cycle, and the scale is as large in the larvae of the Thalassinidea and Anomura as it is in any other Decapods. The organ is therefore not wholly lost, and there is no reason why it should not either have persisted throughout in certain lines or be re-acquired in the adult by persistence of a larval character.

ANOMURA.

Galatheidea.

Large eggs, with an abbreviated or suppressed larval life, are commonly found among the Galatheidae of the deep sea such as *Diptychus* and *Galathodes*, but

Milne Edwards and Bouvier point out (1893, p. 234) that there is no definite relation between the depth of the habitat and the size of the egg. For instance, some species of *Munida* live at the same depth as *Galathodes* and *Diptychus* and yet have small eggs. But a large proportion of the Galatheidae, and apparently all the Porcellanidae, are littoral species and have free larvae, so that it is to be expected that these larvae should be taken in considerable number and variety in the plankton. This is indeed the case, and the "Terra Nova" collections contain larvae of Galatheidae and Porcellanidae in abundance.

Larvae of the Galatheidae and of the Porcellanidae have been repeatedly described, but the most comprehensive account is that of Sars (1889), who described fully the development of species of *Galathea*, *Munida*, *Galathodes*, and *Porcellana*, while Faxon has dealt in some detail with *Porcellana* (*Polyonyx*) *macrocheles* (1879).

As is to be expected in the case of two such closely related families as the Galatheidae and the Porcellanidae the essential characters of the larvae are practically identical, and it is difficult to frame any definition which will distinguish them. If it were a case of comparing those of *Galathea* or *Munida* with *Porcellana* a distinction would be easy, but a series of larvae taken in Melbourne harbour and described below so completely bridges the gap between the two families that a real distinction becomes out of the question. The following summary of the chief characters of the Galatheid larva must therefore be taken as applying to the tribe as a whole. It will be seen later that it is almost equally difficult to find characters for the separation of the larvae of Galatheidea from those of the Paguridea.

Characters of the Galatheidae.

1. Rostrum long, broad at base, dentate along margin in *Galathodes*.
2. No supra-orbital spine.
3. Posterior margin of shell usually (always ?) dentate and produced into a short spine on either side.
4. Abdomen without median dorsal spines on somites 1 to 4. Lateral spines usually present, especially on somite 5.
5. Telson with second seta reduced. The fourth seta becomes a large spine in later stages. No median spine.
6. Antennal scale with terminal spine large or very large. Scale sometimes acicular (*Munida*). Inner branch usually with one seta, rarely with two in stage I.
7. Exopodites on all three maxillipedes. Endopodite of third pair rudimentary and basally placed.
8. Exopodite of second maxilla bears setae on its proximal lobe. Four inner lobes, of which the basal lobe is the largest.
9. Fifth pair of legs placed inside and hidden by legs 3 and 4.
10. Pleopods absent from first abdominal somite, and also from the fifth in *Diptychus* (Bouvier, 1892).

The Porcellanidae, if the species described below is properly referred to that family, share all these characters with only two important exceptions, namely :

1. The rostrum and posterior spines of the carapace are enormously long.
2. There are no teeth on the posterior edge of the carapace.

The genus *Porcellana* itself has some peculiar features—*

(*a*) The antennal scale is reduced to a spine.

(*b*) Peculiar form of the telson which may, in some species, have a median spine.

(*c*) In some species (e. g., *P. longicornis*) the fifth pair of pleopods are absent, as in *Diptychus*.

I. Galatheidae.

The characteristic larva of the Galatheidae has been so fully described by Sars and others that it is unnecessary for me to deal with the representatives of the genus from the "Terra Nova" collections, especially as it is out of the question to refer them to any adult species. The accompanying figure (fig. 69) of the larva of a species of *Munida* (from station 106) will give a good idea of the Galatheid type of larva, and shows that the rostral and posterior spines which attain to such extreme dimensions in the Porcellanidae may be of great length in the Galatheidae.

The great length of the spine of the basipodite of the second antenna, which is rather a feature of the Anomura in general, is particularly noticeable in *Munida* where this spine exceeds the endopodite in length. In the Brachyura it is always of great size. This larva also shows the peculiar form of the antennal scale which characterizes the genus. The larva illustrated is in the first stage, and the telson has a form quite unlike that found in the later stages (Sars, 1889, pl. 6). The great development of the first seta into a spinous prolongation of the telson is a feature peculiar to *Munida* as compared with *Galathea*, but, in the last stages it is reduced to a small tooth, and the fourth spine of the series becomes greatly the largest and, like the first spine in stage I, it is fused and not jointed to the telson.

The animal described by Bate under the name of *Zoontocaris* is a larva of *Galathea*, and a precisely similar larva was taken at station 139. Bate's specimen was taken off Cape Howe, Australia.

II. Porcellanidae.

The larva of *Porcellana* has been described or referred to perhaps more often than that of any other Decapod, but it is rather remarkable that no complete account of its transformation has ever been given except that of Faxon (1879), who dealt with *Polyonyx macrocheles*, and that the larvae only of this species

* Miss Webb states (1921, p. 413) that the last larva of *Porcellana* has no exopodite on the third maxillipede. This is not in agreement with the descriptions of Sars and Faxon, or with my own observation. I find a setiferous exopodite in the larva of *P. platycheles* and in all the larvae of this stage in the "Terra Nova" collections.

and of *P. longicornis* and *P. platycheles* have been identified. All the larvae described agree in their general form and in the structure of the appendages, but,

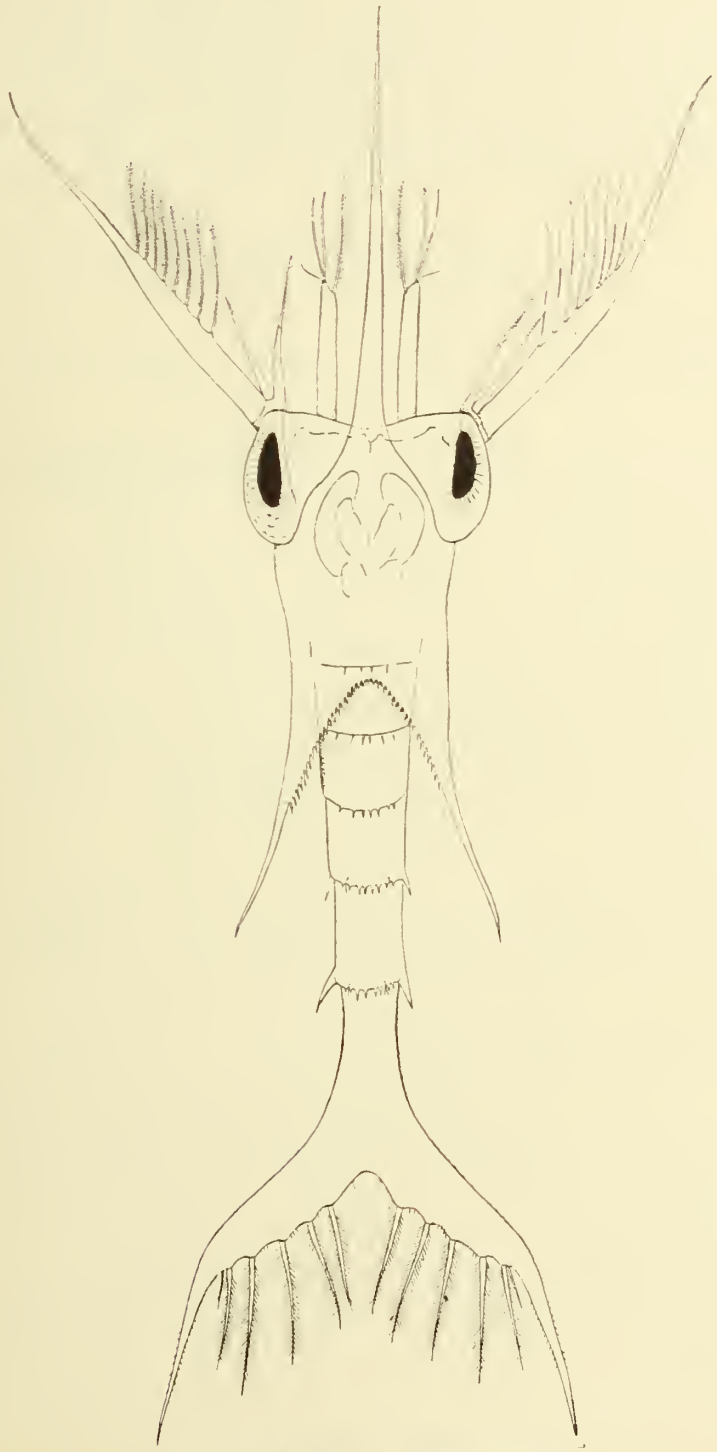

Fig. 69.—*Munida*, sp. Station 106.

whereas the telson of these three species has a formula of 7+7, the larvae of unnamed species have been figured by Claus and Cano in which there is a large

median spine in addition. There is also a lack of agreement as to the number of pleopods developed, since there appear to be only three pairs in *P. longicornis* and *P. platycheles* and four in all others. The complete suppression of the uropods in larval life is a remarkable feature characteristic of all Porcellanid larvae hitherto described, and unknown elsewhere except in the case of some Caridea with abbreviated larval life; but it is not invariably characteristic for the family if the larva described below is really a Porcellanid.

Porcellanid larva.

Melbourne harbour (fig. 70).

Stage I. Length—Rostrum, 4·35 mm. Posterior spines, 3·75 mm. Total length, 9·75 mm.

The rostrum and posterior spines at this stage appear quite smooth, but have very minute spinules, and the carapace has no spines or marginal spinules.

The abdominal somites have no spines.

The telson (fig. 70, *c*) is quite unlike that of *Porcellana*, being more or less triangular with a rather deep sulcus. It bears a short spine at its outer angle and seven ciliated setae on either side (formula 8 + 8) of which the outermost is the shortest. But this seta is by no means so small as is usual in the Anomura and Thalassinidea.

Cano (1893, Taf. 2, fig. 82) figures the telson of a species of *Porcellana* in the last stage in which the second seta is almost of the same size as the others, whereas in other species it is reduced to a small hair.

In respect of the appendages this species also diverges to some extent from *Porcellana*. The first antenna is as usual a short unsegmented rod with aesthetes, but the second antenna has a well-developed scale with marginal setae, whereas in *Porcellana* the scale is reduced to a spine. In this respect *Porcellana* shows an advance to the condition found in the Brachyura, but the primitive form of a scale-bearing setae is retained both in the Brachyura and in *Porcellana* up to the time of hatching. In *P. longicornis* the appendage in the unhatched embryo has a scale considerably longer than the endopodite and bearing five large ciliated setae, while the endopodite bears one such seta. The appendage has, in fact, at this stage a close resemblance to that of *Galathea*.

The mouth-parts are of the usual form, and the first pair of maxillipedes resemble those of *Porcellana* in having the endopodite four-jointed, but the exopodite bears five setae instead of four.

The third maxillipede is, on the other hand, rather more developed than is the case in *Porcellana*, the exopodite being large and with five setae. The endopodite is rudimentary and springs from the base of the basipodite.

Small rudiments of all the five pairs of pereiopods are present, that of the fifth being placed inside and hidden by the third and fourth pairs. Each of the first four

pairs has a small forwardly turned papilla at its base which represents a rudimentary gill.

There is no trace of pleopods.

Stage II. Length—Rostrum, 7 mm. (fig. 70, *b*). Posterior spine, 4·65 mm. Total length, 13·85 mm. (A second specimen measured 12 mm.)

The enormously long rostrum has now a few small spines along its ventral side, while the posterior spines have three strong spinules near the base. There is a small

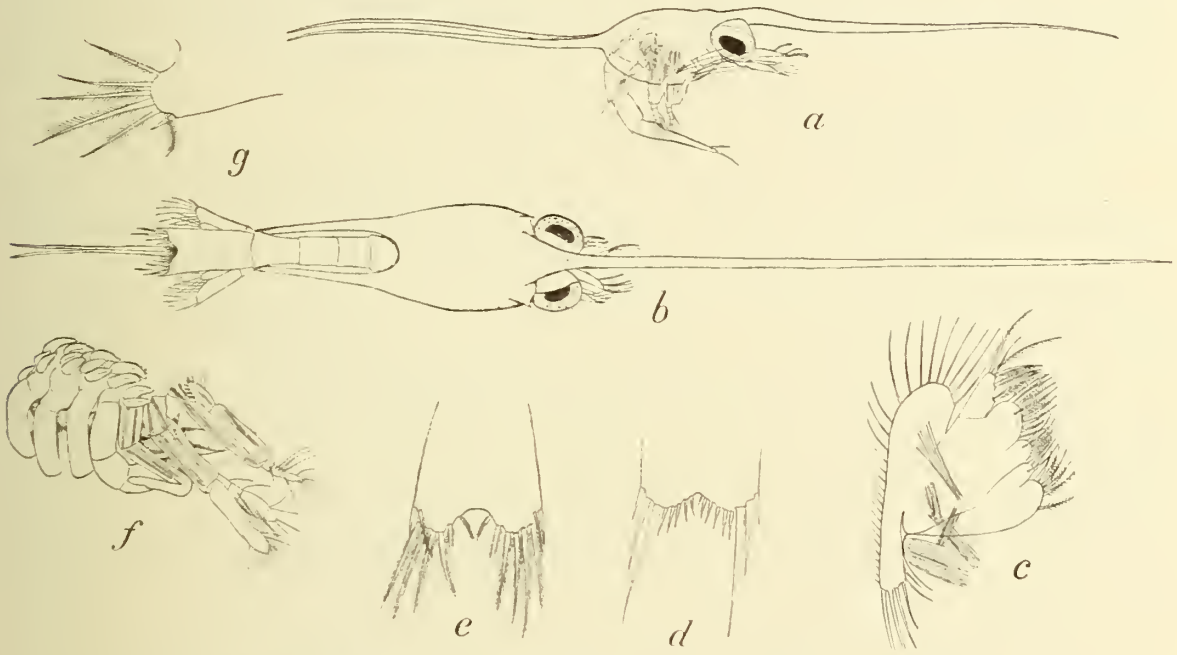

Fig. 70.—*Porcellanid.* Melbourne harbour. *a.* Stage I. *b.* Stage II. *c.* Second maxilla. Stage III. *d.* Stage III. Telson. *e.* Stage I. Telson. *f.* Stage III. Pereiopods. *g.* Telson of youngest stage. Station 136.

spine on each side at the level of the eye corresponding to supra-orbital spines—a most exceptional feature in Anomura.

The abdominal somites have no dorsal spines, but there are very small ventro-lateral spines on somites 4 and 5. The telson is more or less rectangular, the width about half the length, and slightly hollowed posteriorly. The formula is, as before, 8+8, but the number is not invariably the same and I have seen two specimens in which it was 10+8 and 9+8 respectively. The second seta is now much smaller and, springing as it does from the ventral surface, it is not easy to see. The fourth spine is greatly the largest, and this and the two outer spines are smooth.

The first two pairs of maxillipedes remain the same, but the endopodite of the third pair has grown into a large rod, but is unjointed and without setae. Its exopodite bears eight setae, while that of the first two pairs have ten.

The pereiopods have greatly increased in size, but there is no sign of pleopods.

The uropods are developed and both branches bear setae.

Stage III. Length—Rostrum, 5·8 mm (end broken). Posterior spine, 4·4 mm.

The rostrum bears very minute spinules, but the posterior spines are bare except for about four strong spinules near the base on the ventral side.

The abdominal somites have no spines, except a very minute lateral pair on the fourth somite and a larger pair on the fifth. The telson scarcely differs from that of stage II, and, in the single specimen available, has a formula of 9 + 8 (fig. 70, *d*). The reduced second seta was not seen, and has evidently been completely lost, since there can be no doubt that the very large spine which appears to be the third is really the fourth of the series.

The appendages are much further developed.

The first antenna has an unjointed stem and two short one-jointed branches, the outer bearing clusters of aesthetes. In the second antenna the endopodite greatly exceeds the scale, and is jointed at its base. The scale remains the same.

The mandible has a small unjointed palp without setae, and its edge has strong ridges but no small teeth.

The second maxilla (fig. 70, *c*) has four well-defined inner lobes of which the proximal is larger than the second.

The first maxillipede is unchanged, the endopodite remaining very small, but the exopodite bears ten setae.

The second maxillipede has the endopodite large, the third joint much swollen. The exopodite bears about thirteen setae.

The third maxillipede has a large but undifferentiated endopodite bending forwards under the preceding appendages.

The pereiopods (fig. 70, *f*) are very large, the first pair with rudimentary chelae, and the fifth hidden beneath the fourth pair. The third and fourth pair have the appearance of enclosing either a chela or two apposed spines at their ends under the cuticle, while the fifth pair is distinctly bi-lobed at the end.

The gills are well developed, as follows :—

	Mxp. 3	Leg 1	2	3	4	5
Arth.	2	2	2	2	2	—
Pleur.	—	—	1	1	1	1

There is no sign of epipodites.

Although this must be the last larval stage there is no trace of pleopods. This is the only example known of a Decapod in which the pleopods are entirely suppressed in larval life.

At station 136 a single specimen of a Porcellanid larva was taken which either belongs to the same species as that above described or at all events to one closely allied to it. It is apparently in the first stage after hatching and is younger than the larva described above as stage I.

The rostrum is broken, but the posterior spine measures 2·85 mm. and the body 1·15 mm. The rostrum is very spiny and the posterior spine, in addition to the large spinules at the base, has a number of smaller spinules scattered along its whole length.

Somites 3 and 4 of the abdomen have very small ventro-lateral spines.

The telson is triangular, with a deep sinus (fig. 70, *g*), and bears a short spine at each angle and six feathered setae. The first of these (no. 2 in the series) is much larger than is usual in the Anomura.

The antennal scale is as in the larva just described, having a long terminal spine and five setae. The endopodite is a small knob, and there is a short stout spine on the basipodite.

The endopodite of the first two maxillipedes is very small and four-jointed, while the exopodite has four setae.

The third maxillipede is a short uniramous rod without setae, and there is no trace of pereiopods.

The larvae just described emphasize most forcibly the extremely close relationship between the Galatheidae and the Porcellanidae. Between them and the larvae of the Galatheidae there is no distinction possible except as regards the enormous development of the rostrum and posterior spines and the absence of serration on the carapace. These characters give the animal so close a resemblance to the larva of *Porcellana* that there can be little doubt that we are dealing with a Porcellanid, but in the presence of uropods and of an antennal scale, and in the form of the telson the contrast with *Porcellana* is profound.

In respect of these characters this larva is more primitive than *Porcellana*, but in the total loss of the pleopods in larval life it is more specialized. There is a tendency to loss of pleopods in *Porcellana* since some species have none on the fifth somite. This peculiar character is found also in *Diptychus* (Bouvier, 1892) but is unknown in any other Decapod.

Paguridea.

The development of a number of Paguridea is known, the best accounts being those of Sars (1889), Thompson (1903), and Issel (1910). So far as is known all species have free larvae, but in the case of *Lithodes* and of *Paguristes oculatus* larval life is to some extent abbreviated. There are generally four Zoea stages followed by transformation to a symmetrical post-larval or Glaucothoë stage. The Glaucothoë is a free-swimming stage during which transformation of the internal organs occurs, so that at the next moult the adult structure and torsion of the abdomen is obtained. A full account of this transformation is given by Thompson, who devoted special attention to this phase and to the question of the relation between the torsion of the abdomen and the choosing of a shell.

So far as concerns the larval stages the Paguridea very closely resemble the

Galatheidea, and the summary of the characters of the latter given on p. 175 applies also to the Paguridea with the following exceptions.

1. The rostrum is usually shorter, but may be very long, e.g. *Eupagurus bernhardus.*

2. The carapace is never serrated posteriorly and is never produced into a long spine. It may be simply rounded behind (*Paguristes oculatus*) or it may be pointed, but it is commonly produced into a more or less down-curved hook.

3. The scaphognathite of the second maxilla lacks setae on its proximal part. It is not quite clear whether this is so in *E. longicarpus* (Thompson, Pl. V, fig. 11), but I have found it to be so in such larvae as I have examined, and Sars figures the proximal lobe as bare in the species dealt with by him.

4. The distal lobe of the first maxilla has only two large spines in early stages.

5. The telson is never so deeply incised as it is in the Galatheidae, and often has a convex posterior margin. The arrangement of the spines is the same. The second seta is always reduced to a very small hair which may be so small that it can only be seen with great difficulty in ventral view. The fourth spine is, as in Galatheidae, in late stages a prolongation of the telson and not jointed off from it, but it is variable in size in different species and may be reduced to a mere point.

6. The fourth leg, though still as a rule visible in side view, tends to move inwards below the other legs. The fifth pair is always completely hidden as in the Galatheidae.

Although I have had numbers of Pagurid larvae for examination, none of these can be referred to their adults, and for the most part they do not possess any structural features sufficiently striking to require description. One larva only may be mentioned which very closely resembles that of *Spiropagurus chiroacanthus*, and it is necessary to describe one post-larval stage and to enter into the question of the significance of the genus Glaucothoë.

Spiropagurus (*?*), sp. (fig 71.)

The larva here figured was taken at station 109. It is apparently in the first stage and measures 3·65 mm.

A detailed description is unnecessary, since it agrees very closely with the description given by Sars (1889) of *Spiropagurus chiroacanthus.* The following points may however be mentioned.

1. First maxilla. The distal lobe is armed only with two very large spines, with one small one between. This seems to be a feature characteristic of the Paguridea, at all events in the first stage, since it is found in each of the species figured by Sars. There is a tendency to a reduction of the spines in the Galatheidae, but it is not so pronounced as it is in the Paguridea.

2. The mandible is of remarkable size, the anterior part being produced into a long pointed process. There is no palp at this stage.

3. The third maxillipede is present and uniramous, but this branch represents the exopodite, as it has, at its base, a very minute papilla which is the rudimentary endopodite. The Paguridea may in fact be regarded as hatching with three pairs of biramous maxillipedes of which the third is rudimentary.

4. The posterior margin of the telson is convex, with a formula of 8 + 8, the second seta being a small hair and the fourth a rather large spine. In the next stage the telson is precisely the same.

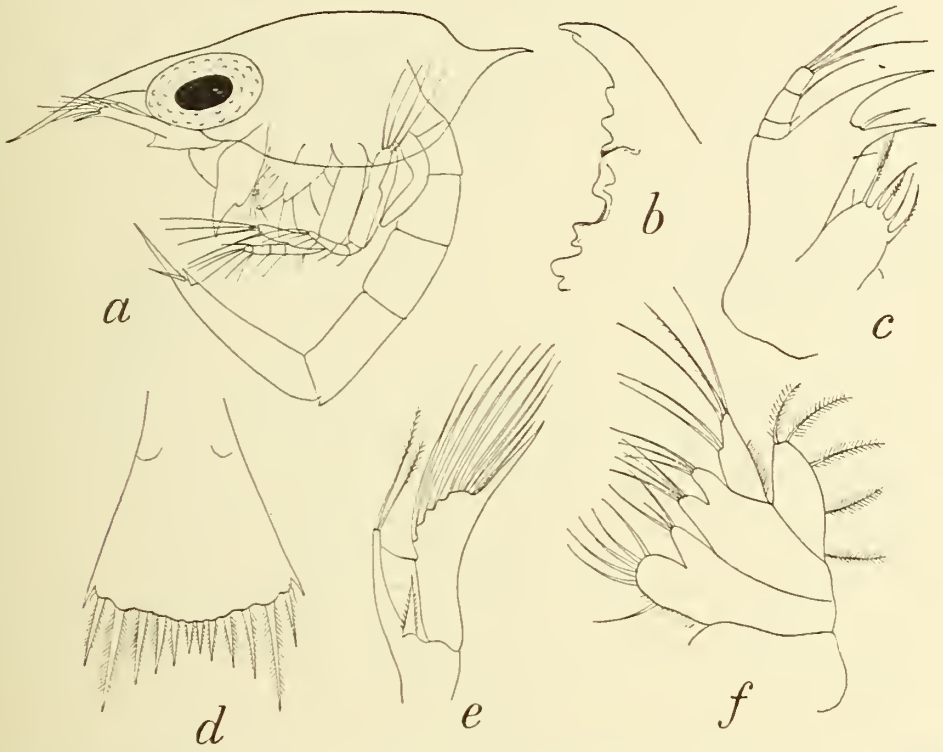

Fig. 71.—*Spiropagurus* (?), sp. Station 109. *b*. Mandible. *c*. First maxilla. *d*. Telson. *e*. Second antenna. *f*. Second maxilla.

Glaucothoë peronii, M. Edw. (fig. 72), and the Glaucothoë stage.

The Glaucothoë or free-swimming first post-larval stage is very commonly taken in plankton, and a fair number were found in the "Terra Nova" samples at stations 130, 132, and 232, but in every specimen the chelipeds, and in most of them the remaining legs, were lost, so that it is impossible to identify and useless to describe them. One specimen, however, which was taken at station 107 deserves some description, since it is identical with *Glaucothoë peronii*, M. Edw., and differs absolutely from the Glaucothoë stages of those species of which we know the development.

This Glaucothoë stage corresponds to the Megalopa of Brachyura and is a transition from larva to adult. It has lost most of the characters of the larva both in body form and in form of the appendages, but it has not wholly acquired the adult

characters of either. On the other hand, these forms are all quite recognizably Pagurids, and in all cases the eyes are reduced to the shape and small size of the adult, and ophthalmic scales are present.

In the specimen now in question (fig. 72) although the appendages have all changed to the form characteristic of adult Pagurids, the eyes remain of large elongated-oval shape with large facets and resemble most closely the eyes of larval Thalassinidea.

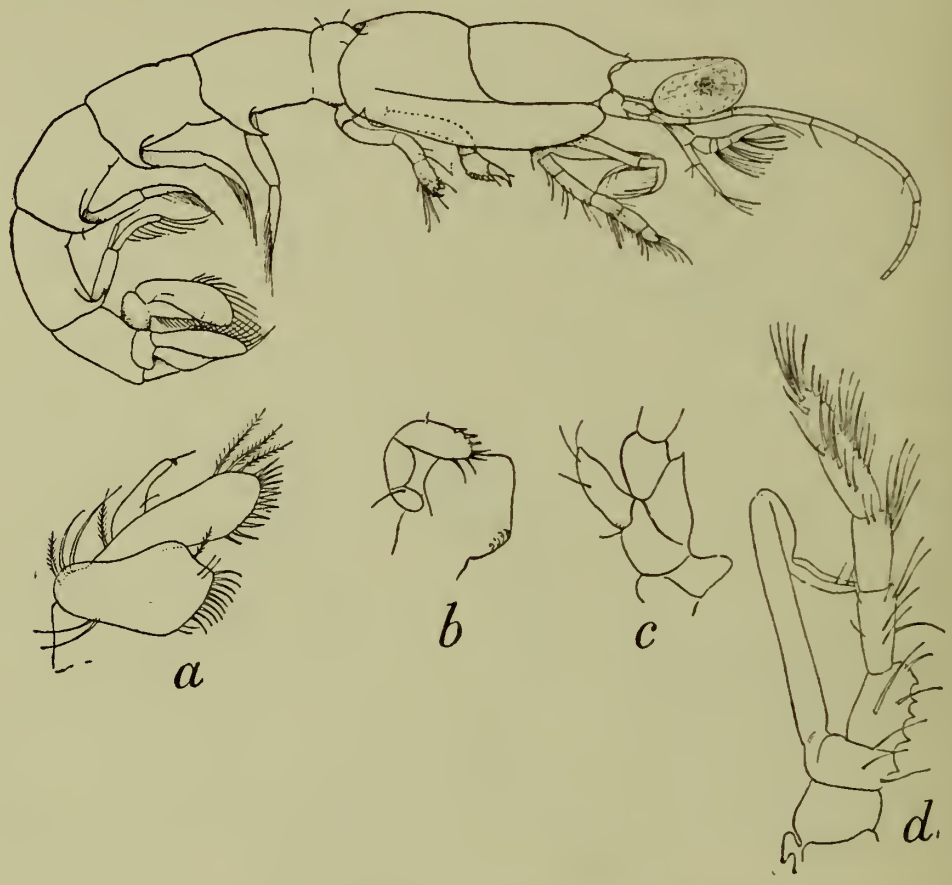

Fig. 72.—*Glaucothoë peronii*. Station 107. *a*. First maxilla. *b*. Mandible. *c*. Stem of second antenna showing vestigial scale. *d*. Third maxillipede.

These eyes are scarcely pigmented, such dark pigment as there is being confined to the ommatidia of the anterior part.

The abdomen is very much larger than is usual in the Glaucothoë stage of normal Pagurids and is only slightly down-curved, while the epimera of somites 2 to 5 are produced downwards into procurved hooks recalling those of the larvae of *Jaxea* and *Naushonia*. In fact, the shape of the eyes and of the abdomen give the animal a striking resemblance to a Thalassinid.

On the other hand, the appendages are unmistakably those of a Pagurid, as is also the gill formula. There are at this stage only six fully developed phyllobranchs on each side, but traces of others are visible as follows:

	Mxp. 1	2	3	Leg 1	2	3	4	5
Epip.	—	—	1	—	—	—	—	—
Arth.	—	—	rud. ?	2 r.	1 + r.	2	2	—
Pleur.	—	—	—	—	—	—	1	—

The animal unfortunately lacks all legs except the fourth and fifth. Two of the walking legs were found loose in the collection, but the chelipeds were altogether lost.

The resemblance of this specimen to *Glaucothoë peronii* in respect of the two characters wherein they both differ from all other Pagurids, namely the size of the eye and the epimera of the abdominal somites, is obvious and complete. There cannot, in fact, be any doubt that both belong at least to the same genus, but it is remarkable that, whereas *G. peronii* measures about 15 mm., my specimen is only 7·75 mm. long.*

I am indebted to Dr. Calman for the opportunity of examining some specimens of Glaucothoë from South Africa (35° 55′ S., 17° 6′ E., depth 1014 fathoms), among which are four specimens which are undoubtedly identical with *G. peronii*, M. Edw. They measure about 14 mm., and the eyes, though very large, are not quite so large in proportion to the body as in the small specimen described above. The structure of the appendages is the same in all essentials, and the epimera of the abdominal somites have the same procurved hooks. Glaucothoë of this form are therefore to be found varying in size from about 7 to about 15 mm., and in the Pacific and the north and south Atlantic. Milne Edwards's type was believed to come from "Asiatic Seas," and Bouvier has recorded its occurrence on four occasions off the coast of N.W. Africa between 20° 38′ and 31° 44′ N. Lat. and 19° 37′ and 42° 31′ W. Long.

G. hendersoni, Bouvier, which was taken between the Maldives and Cape Comorin (Henderson, 1896), has not been fully described, but it is evidently closely allied to *G. peronii*. Alcock says of it (1905, p. 23) that it has "the same enormous squilla-like eyes" as *G. peronii*.

Here is the old Glaucothoë problem revived! The facts are these: from time to time there have been found, generally in deep water, rare examples of free-swimming symmetrical Pagurids measuring from 14 to 20 mm. to which specific names have been given on the assumption that they are adult or semi-adult forms. There can be no doubt that they are not adult forms, but, in that case, of what kind of Pagurid can they be the larvae? Three points are of the greatest importance—they are of large size, they are very rare, and they have all the mouth-parts fully developed and of the adult form. In all these points they differ totally from the so-called Glaucothoë stage of the European littoral Paguridea. Bouvier has dealt in great detail with the significance of these remarkable forms (1891, 1905), and came to the conclusion that each of the known species of Glaucothoë could be referred, mainly on the evidence of the gills, to some known genus of Pagurid of which it was an early

* Bouvier (1905) records specimens of *G. peronii* of 12 mm. and of 7 mm.

post-larval stage. Thus *G. peronii*, which has the gill formula of *Eupagurus*, he refers to *Sympagurus*.

Bouvier's conclusion as to the nature of these curious animals is that they are larval forms arrested in development either by reason of failing to obtain shells, or of being carried away by currents outside their natural habitat. In ordinary circumstances the Glaucothoë stage lasts but four or five days (Thompson, 1903, p. 202), and the moult to a symmetrical form takes place whether a shell is found or not; but in the case of the true Glaucothoë the asymmetrical form is not assumed and growth continues. A similar explanation has been given for the exceptionally large Caridean larvae which have occasionally been taken.

No final answer to this difficult problem is possible without keeping the animals under observation, but I find Bouvier's explanation difficult to accept for the following reasons:

1. While the Glaucothoës have the appendages of the adult form, or more developed than in the "Glaucothoë stage," they are less advanced than this stage in their lack of ophthalmic scales and in the form of the tail plate. In respect of these characters they represent a stage which is not found at all in the ontogeny of any species of which the development is known. It is not, therefore, a case of further development of a known form, but of an entirely different organization. The Glaucothoë stage always has these ophthalmic scales and a tail plate with more or less asymmetrical uropods.

2. Of the true Glaucothoës there are only five "species" known, and some have been repeatedly seen, while Bouvier has found examples of *G. peronii* and of *G. rostrata* of very small size—4 mm. in the case of the latter.

From these facts one is justified in concluding that there exist certain species of Paguridea whose first post-larval state differs from those hitherto known in having, for example, no ophthalmic scales, and which have also a more prolonged post-larval ife than is usual. Since there are recognizable "species" the course of development is in each case definite and specific, and in all probability it leads in the end to transformation to an asymmetrical adult. One would be inclined to suggest that they belong to the large species of *Coenobita* or to *Birgus*, but the gill formula seems to exclude such a possibility.

If Bouvier's theory were correct there seems to be no reason why Glaucothoë stages of the normal form (with ophthalmic scale) should not sometimes grow into the large Glaucothoë form. It might be answered that, for some reason, this scale is always lost when such an abnormal development supervenes, and that the uropods also become transformed. But the peculiar *G. peronii* stands in the way of such a supposition, since it is hardly permissible to postulate that the eyes themselves should revert to the larval condition, and that the epimera should take on the very special form characteristic of that species.

Well-founded knowledge of Pagurid development is far too scanty to permit of

any definite conclusion on this question, and the very incompleteness of our information is a strong reason for refusing at present to accept abnormality as an explanation.

That the Glaucothoës are immature there can be no reasonable doubt, and they should be accepted provisionally as normal stages in development. Probably the adults to which they belong live at great depths, and an extended post-larval life may be connected with this habitat. The Sergestidae and some Penaeidae (e.g. *Funchalia*) have a long series of post-larval stages, and it may be found that this is characteristic of deep-sea forms.

Hippidea.

The larvae of *Hippa* and of *Albunea* have been described and figured by various authors, but only that of *Hippa* has, so far as I can ascertain, been definitely identified by hatching from the egg (Faxon, 1879). At the same time there is no reason to doubt the identification of the larvae of *Albunea* by Claus (1876), Boas (1880), and Cano (1893). Cano (1893) has also described the Zoea of *Remipes*, so that the characters of the group are sufficiently established. The following characters are common to the three genera:

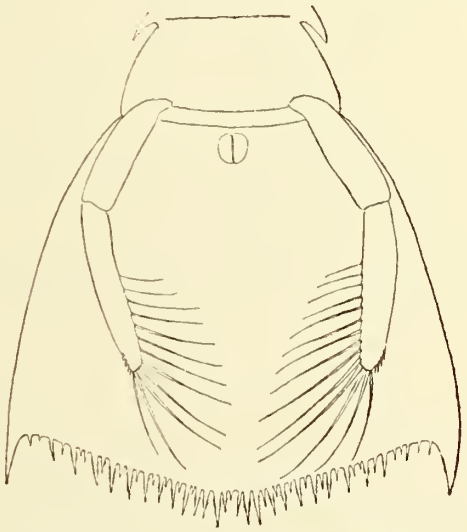

Fig. 73.—*Albunea*, sp. Telson and uropods. Station 39.

1. Carapace, at least in later stages, with large postero-lateral or lateral spines.

2. Telson more or less quadrangular, with entire posterior margin armed with numbers of small denticles. No median spine or reduced second seta.

3. Second maxilla with inner lobes reduced or absent.

4. Pereiopods without exopodites. Exopodite present on third maxillipede in *Albunea*, but absent in *Remipes* and *Hippa* (?). In *Albunea* the endopodite is basally placed.

5. Antennal scale well developed in *Albunea* and *Remipes*, but absent in *Hippa*.

In their general characters these larvae are typically Anomuran. Their chief distinguishing feature is the large spade-shaped telson with its small denticles.

Albunea (fig. 73).

At station 39 some larvae were taken which entirely agree with the description of the Zoea of *Albunea* as given by Claus (1876, p. 59). The larva has, at first sight, somewhat the appearance of a Brachyuran, but the telson and appendages are quite of Anomuran form. *Albunea* differs from *Hippa* and *Remipes* in having the uropods uniramous.

DROMIACEA.

The information available with regard to the Dromiacea is by no means complete. The Zoea of *Dromia* has been traced from the egg (Gourret, 1884; Cano, 1893), while Boas has also described a late stage of the same genus. Cano has figured some stages in the development of *Dynomene*, *Latreillia*, and *Homola*, but his identification of them is not beyond question and the information given is scanty. Boas has also identified the larva of *Homola*, and his figures both of *Dromia* and of *Homola* are excellent.

Assuming these larvae to have been correctly identified their characters may be combined as follows:

1. Rostrum long; carapace without supra-orbital spines, either rounded behind or with a short posterior spinous projection similar to that of Paguridea.
2. Telson very variable. Formula 7 + 7 in *Dromia* and 7 + 1 + 7 in *Latreillia* (doubtful in *Dynomene*). In both cases with reduced second seta. In *Homola* it is of special form, with very numerous spines and a small median spine.
3. Second antenna with large scale, sometimes (*Dromia*, *Homola*) with setae along outer margin.
4. Third maxillipede with exopodite, the endopodite rudimentary and basal.
5. Exopodite on first leg in *Dromia* only.
6. Pleopods absent from somite 1.
7. Second maxilla with four well-defined lobes.
8. Mandible with palp in later stages.

The systematic position of the Dromiacea has, on the evidence of the adult anatomy, been a subject of considerable difference of opinion, and they have been associated on the one hand with the Anomura and on the other with the Brachyura. Boas, who appreciated the importance of the larval characters, and gave a long list of adult features wherein the Dromiacea resemble the Anomura, concluded by grouping them within the Brachyura, but derived them from an ancestral form more primitive than the Anomura. Bouvier (1896), after discussing all the evidence both from the adult and from the larvae, concluded that they are Brachyura and stand in the line of descent of the Brachyura, not from the Anomura or the Thalassinidea, but from the Homaridea. Calman (1909) accepts the Dromiacea as a tribe of Brachyura equivalent to the tribes Oxystomata and Brachygnatha.

Bouvier seems to have felt the difficulty which the development of *Dromia* placed in the way of his argument and treats the evidence, as it seems to me, in rather summary fashion.

Arguments derived from or sustained by the general facies of a larva and not supported by other structural features are likely to prove unreliable, and Bouvier is quite justified in dismissing Cano's derivation of *Latreillia* from the Paguridae and

its separation from the remaining Dromiids, which Cano considered to be descended from the Thalassinidea. But he is certainly not justified in concluding that it is equally easy to derive the larva of *Dromia* from that of a Homarid as from that of a Thalassinid. The Homarid larva is of very primitive type in which *all* the pereiopods have exopodites, all the endopodites are normal and functional, and the telson has a median spine and numerous sub-equal marginal spines. I have attempted to show that the Thalassinidea fall into two groups, a Homariform and an Anomuriform series, and the latter is characterized by two features which are of the highest systematic importance and are repeated without exception throughout the Anomura, namely the rudimentary condition of the endopodite of the third maxillipede and its position at the base of the basipodite, and the reduction of the second spine of the telson to a small hair (the latter is also shared by the Homarine series). These characters are also found in the Dromiacea, and the only possible conclusion seems to be that they have sprung from an ancestor related to the Anomuriform Thalassinids and resembling *Upogebia* in its larval characters.

The Dromiacea should, in my opinion, not be included at all in the Brachyura, but should form a group independent of both the Anomura and the Brachyura, and it does not seem even to be certain that the Dromiacea stand in the direct line of descent of the Brachyura. The tendency of the whole evidence from larval characters seems to be rather in the direction of the abolition of the larger sub-divisions of the Decapods, and a substitution of a series of smaller groups which do not form a linear series.

Dromiacea species ?

At stations 43, 106, and 129 larvae of two closely related species were taken whose systematic position is extremely doubtful. Unfortunately the specimens are in early stages, and therefore no information can be obtained from their pereiopods or gills. They have the appearance of holding a position intermediate between the Anomura and Brachyura, though belonging to neither. On the other hand, there is a distinct general resemblance to the Zoea of *Homola* as figured by Cano (1893, Taf. 2, fig. 50), and there is the same type of telson. For this reason I refer these larvae to some genus of Dromiacea without attempting any more precise identification.*

Species I. Station 43 (fig. 74).

There are two specimens of this form, both apparently in the first stage. The animal measures about 1·6 mm. from the end of the rostrum round the curve of the abdomen which is curled round under the body.

There is a long rostrum, somewhat turned up at the end, and there is a small

* It is not unlikely that these two larvae may really belong to the Raninidae (Gymnopleura), see p. 194.

stout dorsal spine on the carapace with a short median knob behind it (fig. 74, *a*). The posterior edges of the carapace are fringed with teeth, and there is a large wing-like expansion on either side also bearing marginal teeth and produced into a large, lateral, forwardly directed spine.

The abdominal somites have short median spines and a pair of lateral spines in addition to a dorsal pair of hairs. The telson is of a T-shape, the two arms forming a straight line at right angles to the abdomen. Each arm has a very small terminal spine and six setae, of which the first is not ciliated. This seta corresponds to the

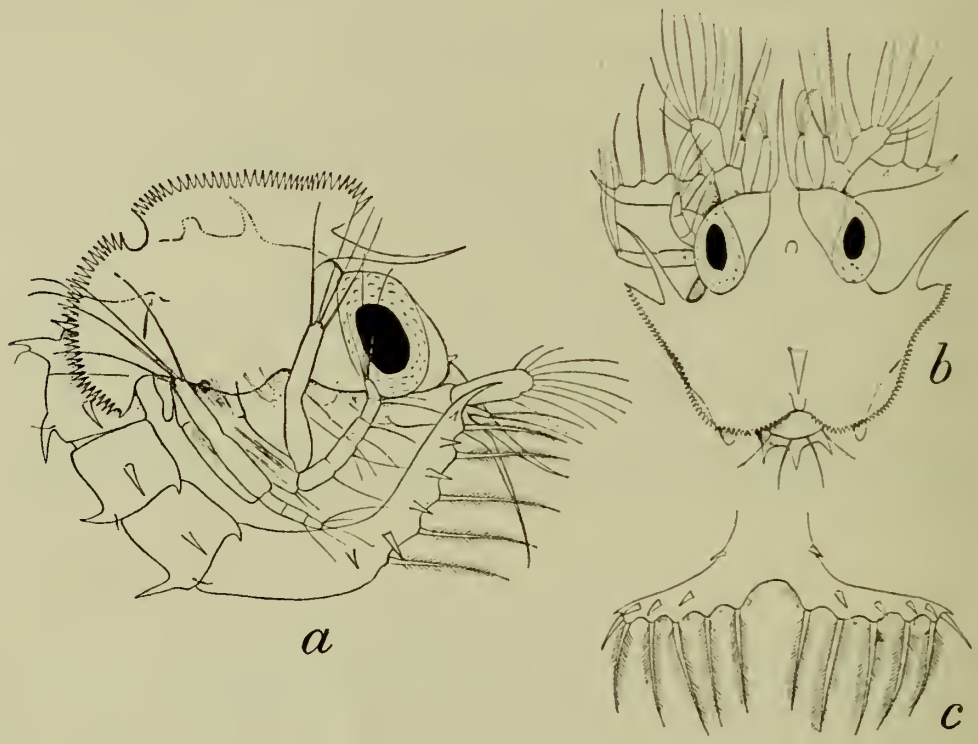

Fig. 74.—*Dromiacea.* Species I. Station 43. *a.* Lateral view. *b.* Dorsal view. Another specimen. *c.* Telson.

reduced seta of Anomura. On the dorsal surface of the telson is a row of three or four strong spines, and there is also another pair at the base of it.

The eyes, the pigment of which is brown, are not mobile, and a small "frontal organ" may be seen on the anterior edge of each.

The first antenna is a short unjointed rod.

The second antenna has a relatively large scale with nine setae, and a short endopodite with two setae, while an enormous spine springs from the basipodite and extends beyond the rostrum.

The exopodites of the first two pairs of maxillipedes bear four setae. The third pair is represented only by a short uniramous rudiment, and there is no trace of pereiopods.

Species II. Stations 106 and 129 (fig. 75).

The species from station 106 differs from that above described in the lack of a dorsal spine on the carapace and of the great lateral toothed wings. There is, however, a pair of simple lateral spines.

The abdominal somites also have no dorsal spines, and lateral spines are present only on the fourth and fifth somites.

The telson is rather triangular in shape, the arms not being long and narrow as in the first species. Each arm has a strong terminal spine and five ciliated setae.

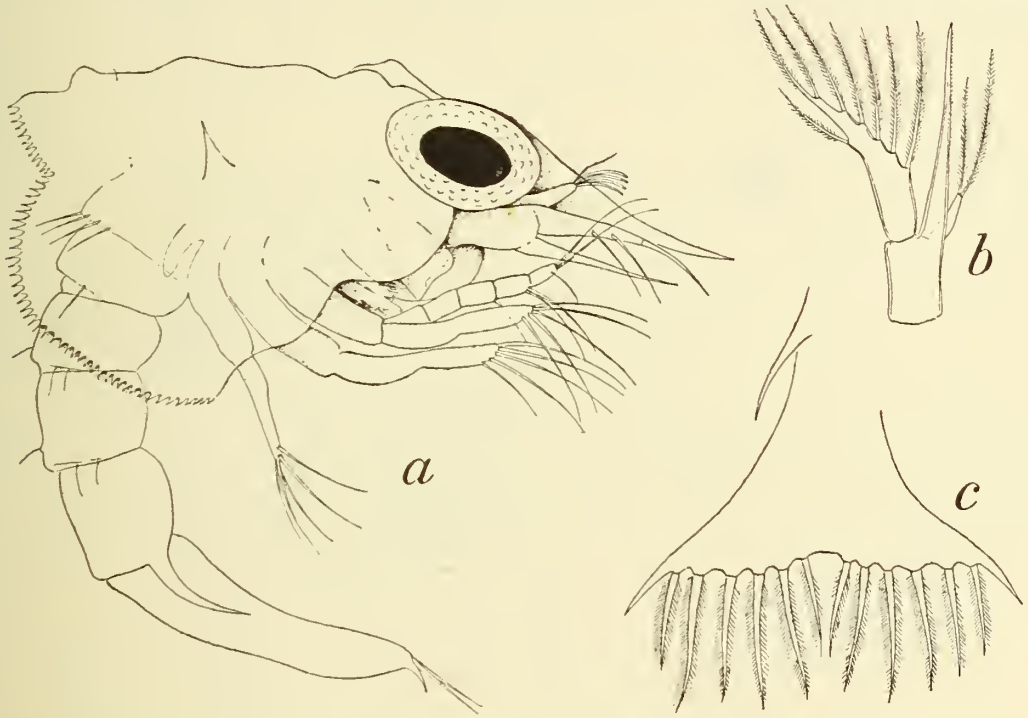

Fig. 75.—*Dromiacea.* Species II. Stations 106, 129. *a.* Larva from station 129. *b.* Second antenna. Station 106. *c.* Telson. Station 129.

There are only six setae (including the spine) on either side, and I have no doubt that the second seta has been entirely lost.

A specimen from station 129 which is in a slightly older stage, has a formula of 7 + 7 which rather confirms this view, since it is usual for an additional seta to be present in the second stage.

The appendages are essentially the same as in the first species, the second antenna having the same huge spine. In the older specimen the third maxillipede is developed, having an exopodite with four setae. The endopodite is very small, at the base of the appendage, and with one seta at the end of it.

Dromiidae.

Species I. Station 43 (fig. 76).

The larva here described so closely resembles that of *Dromia* in the form of the second antenna and of the telson, and in the presence of an exopodite on the first leg

that I have no hesitation in referring it to the Dromiidae, even though it probably does not belong to the genus *Dromia* itself. Three stages are represented, of which the second may be described.

Stage II. Length, 3·6 mm. (fig. 76, *a*).

The carapace extends over the eyes as a broad rostral process with two lateral and a median spine. There are neither dorsal nor posterior spines, but the posterior edge is simply rounded and denticulate. The surface of the shell posteriorly has distinct concentric striae. A deep transverse groove anteriorly seems to correspond to the " mandibular groove."

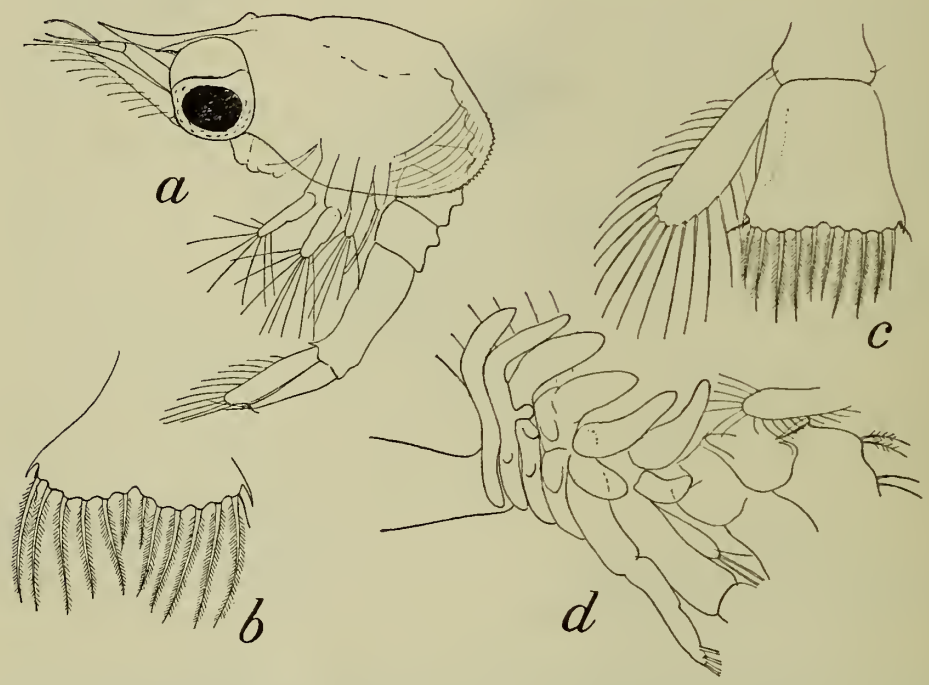

Fig. 76.—*Dromiidae* species. Station 43. *a*. Larva, 3·6 mm. Stage II. *b*. Telson. Stage I. *c*. Telson. Stage II. *d*. Gills. Oldest stage.

The somites of the abdomen have no spines, but each has two pairs of small papillae, which give them a ridged appearance in side view. The telson (fig. 76, *c*) is almost rectangular, little broader at the end than the base, and with no median sinus. There is a small spine at each angle and six setae (formula 7 + 7), of which the outer one is very small.

The uropods are present, but the endopodite has no setae and is much shorter than the exopodite, which has no terminal spine.

The first antenna has a one-jointed stout stem, and there is a trace of the endopodite as a minute papilla bearing a seta.

The second antenna has a very large scale bearing setae along the whole of the outer as well as of the inner margin. The endopodite is a short rod without setae.

The mandible has no palp.

The three pairs of maxillipedes are developed and biramous, the endopodite of the third being rudimentary and seated at the base of the appendage.

The first leg has also a seta-bearing exopodite and a rudimentary endopodite, and the rudiments of the succeeding four pairs are visible.

The gills are visible, but not in their full number. There appear to be two rudiments on the third maxillipede and the first leg, and one on each of the following limbs.

The general appearance of the larva differs little by reason of age, but in the first stage the telson (fig. 76, *b*) is triangular and very closely resembles that of *Upogebia* in its first stage, though the formula is 8+8. A further resemblance to *Upogebia* is the presence of three setae on the endopodite of the second antenna at this stage.

In the last stage seen (which is not the last larval stage) the mandible has a rudiment of a palp. The first leg has the endopodite rudimentary, in the form of a small bud at the base of the basipodite. On the following three pairs of legs, which show no sign of joints, there are minute lobes which seem to represent vestiges of exopodites.

It is much to be regretted that there is no older stage which would make this point clear, but it must be admitted that in this young stage the interpretation of these lobes and of the gills is uncertain. There appears to be a line of division across the base of the second leg which would seem to make the distal lobe certainly an exopodite, but the succeeding legs are entirely undifferentiated. I regard the gills at this stage as follows :

	Mxp. 1	2	3	Leg 1	2	3	4	5
Epip.	1	1	—	—	—	—	—	—
Arth.	—	—	2	2	1	1	1	—
Pleur.	—	—	—	—	1	1	1	1

BRACHYURA.

If the Dromiacea be excluded the remainder of the Brachyura (Oxystomata and Brachygnatha) have a characteristic larval type from which few species depart to any great extent. This is so far true that it is as a rule quite impossible to define the Zoeas of separate families or even to distinguish between those of the different tribes and sub-tribes. Here and there a distinguishable type appears to characterize a family, as is the case in the Dorippidae, and here and there a single genus may have a readily recognizable larva, as in *Pinnotheres*, but this is exceptional.

The position of the Raninidae, however, is peculiar. Bourne (1922) has made an exhaustive study of the group and has come to the conclusion that the Raninidae, "though by definition they must still be included among the Crabs, are not derived from a Dromiid ancestor, but have been evolved as an independent group from the Astacura" (p. 28). To this group he gives the name "Gymnopleura." Unfortunately we do not know the larva of any Raninid with certainty, but Cano (1892, p. 21) has

claimed a peculiar larva described by Claus under the name of Acanthocaris as a Raninid,* and, by reason of its "Anomuran" character, has himself concluded that the Raninidae should be excluded from the Brachyura. The reasons for the identification are not conclusive, but if they are accepted the conclusion that the Raninidae should form a separate tribe independently evolved along much the same lines as the Dromiacea cannot be avoided. It is possible that the larvae described above as Dromiacea (p. 189) should really be referred to the Gymnopleura.

The Acanthocaris larva and the two larvae in question provide to some extent a transition to the Brachyurous form, since they show the origin of the dorsal and lateral carapace spines which are so characteristic of the latter.

The peculiar Brachyuran telson is easily derived from the Galatheid type. The embryonic cuticle shows a telson having seven pairs of large spines, of which the fourth is not ciliated and is smaller than the rest. In the Zoea this spine has become a large spinous continuation of the telson, and the other spines are reduced, one or more of them being sometimes absent. The three inner spines are always retained. Throughout the Anomura (and also in some Thalassinidea) the fourth spine is greatly the largest, and in *Munida* the form is almost precisely the same as in the Brachyura.

In the Brachyura the antennal scale is vestigial, but it is well developed in the Protozoea stage, and the great predominance of the basipoditic spine is foreshadowed in the Anomura and still more in the Raninid Zoea.

The larva hatches with two pairs of maxillipedes only, but the third, though rudimentary, is biramous. There are never exopodites on the legs. In these respects there is also agreement with the Anomura.

For these reasons it seems reasonable to derive the Brachyura from a stem common to the Galatheidea and Dromiacea.

In the "Terra Nova" collections Brachyuran Zoeas and Megalopas are common, but it is for the most part quite impossible to refer them to their proper systematic position. Some of the Megalopas, which possibly belong to the Oxyrhyncha, are of striking form, but are of no special interest otherwise. The following alone can be approximately identified with known genera.

Dorippe (*?*) (fig. 77).

At station 39 several specimens were taken of a remarkable Zoea resembling that of *Cymopolia* or *Dorippe* (Cano, 1891), but differing in the great size of the lateral spines, and to some extent in the structure of the telson.

The gill formula differs from that of *Dorippe* only in the absence of epipodites and of gills from the second maxillipede. Cano found in *Dorippe* and *Cymopolia* no epipodite or gill on the second maxillipede, and only a single gill and epipodite on the third pair in the Zoea. It is impossible in my specimens to distinguish between arthrobranchs and pleurobranchs.

* Claus (1885) also attributed this larva to the Raninidae.

Ebalia (*?*), sp.

A single specimen of a larva taken at station 40 resembles in form of telson the Zoea ascribed by Cano (1893) and Williamson (1915) to *Ebalia*, but not identified by them with certainty.

The "Terra Nova" specimen differs from Williamson's larva in having short dorsal and rostral spines and also very small lateral spines, but the telson is so much the same and differs so much from the normal Brachyuran form that the two larvae must at least be closely related.

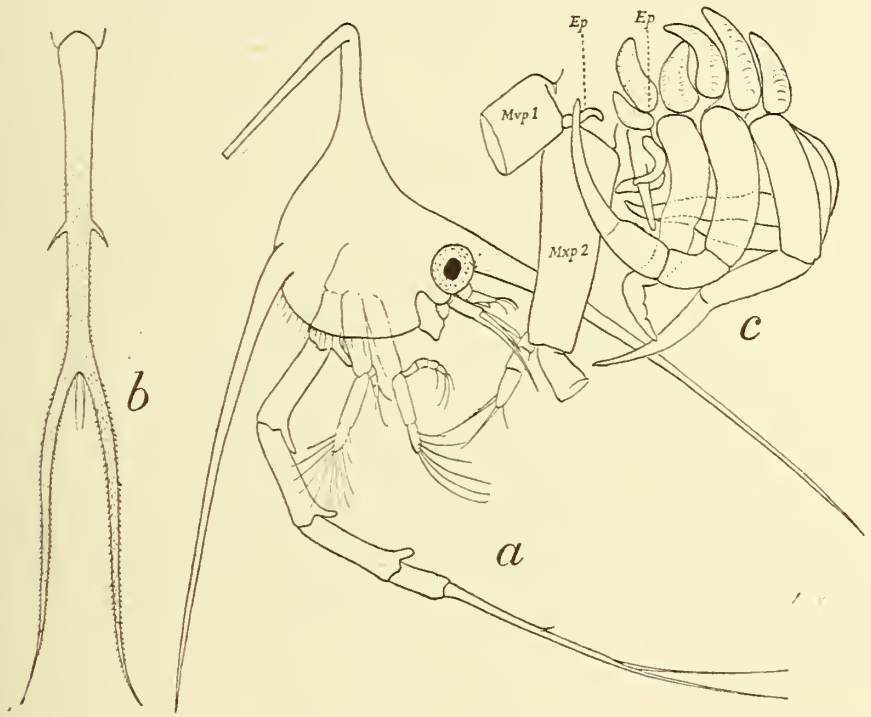

Fig. 77.—*Dorippe* (*?*), sp. Station 39. *b*. Telson. *c*. Pereiopods and gills.

Pinnotheres pisum.

The characteristic Zoea of *Pinnotheres* was taken at stations 97, 148, and 161. As Borradaile records *P. pisum* from two New Zealand stations no doubt these larvae belonged to this species.

Brachyura, *incertae sedis* (fig. 78).

At stations 133 and 135 a peculiar Brachyuran Zoea was taken in some numbers, which is of interest although it is impossible even approximately to identify it.

The body is almost entirely enclosed within the carapace, which measures about 1·2 by 1·35 mm. The rostrum is of fair size, but there is no trace of dorsal or lateral spines.

The second antenna is reduced to a simple unjointed conical structure without setae, and there is no basipoditic spine such as is usual in Brachyura.

In the oldest larvae seen there were no rudiments of pleopods.

The fifth and sixth somites of the abdomen are dilated, the latter expanding into thin lateral plates which extend back and overlap the telson. The latter is of unusual form, but is evidently derived from the normal type, all the outer spines being lost, but the three inner pairs of setae retained.

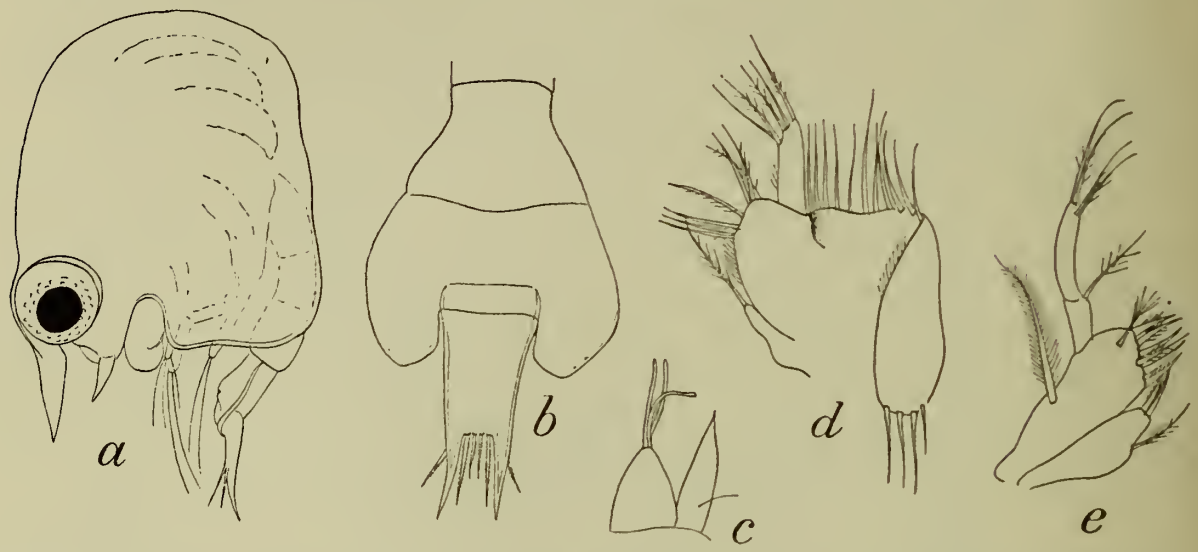

Fig. 78.—*Brachyura*, incertae sedis. *a*. Side view. *b*. Telson. *c*. The antennae. *d*. Second maxilla. *e*. First maxilla.

I cannot find any Zoea described agreeing with this form. The nearest to it is one described by Claus (1876, Taf. XIV, figs. 1–4). This Zoea has, however, lateral spines, but the form of the sixth somite is the same and the structure of the telson somewhat similar.

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IX.—INDEX.

Acanthephyra, 107.
Acanthocaris, 194.
Acanthosoma, 78, 89.
,, dohrni, 92.
,, hispida, 90.
,, stage, 89.
Acetes, 102.
Albunea, 187.
Alpheidae, 118.
Amalopenaeus, 52.
Amphion, 104.
Amphionidae, 104.
ancylifer, Anebocaris, 119.
Ancylocaris, 131.
Anebocaris ancylifer, 119.
Anomalocaris, 142.
Anomura, 174.
antarcticus, Retrocaris, 127.
antennatus, Aristeus, 68.
arcurostris, Icotopus, 116.
Aristaeomorpha, 61, 68.
Aristeinae, 52.
Aristeus, 64.
Aristeus antennatus, 68.
armata, Euphema, 60.
Artemisia, 67.
Astacura, 133.
Athanas, 118, 131.
Atlantocaris, 113.
Axiidae, 142.
Axius stirhynchus, 144.

Benthesicymus, 60, 62.
Brachyura, 193.

Callianassa, 158.
,, subterranea, 161.
Callianassidae, 156.
Callianassinae, 156.
Caridea, 103.
Caridina, 47.
Cerataspis, 51.
chiroacanthus, Spiropagurus, 182.
contraria, Retrocaris, 123.
cornutus, Sergestes, 95.
Crangonidae, 132.
crassus, Sergestes, 94.
crenatus, Platysacus, 73.

danai, Upogebia, 165.
Decapod grade, 43.
Diaphoropus, 118.
Discias, 45.
dohrni, Acanthosoma, 92.
,, Elaphocaris, 79.
Dorippe, 194.
Dromia, 191.
Dromiacea, 188.
Dromiidae, 191.

Ebalia, 195.
Elaphocaris, 78.
,, dohrni, 79.
,, hispida, 85.
,, ortmanni, 84.
Embryocaris stage, 138.
,, stylicauda, 136.
Entomostracan stage, 42.
Eretmocaris, 119.
,, type, 115.
Euphema armata, 60.
,, polyacantha, 63.
Euzoea, 47.

foliaceum, Petalidium, 95.
Funchalia, 68.

Galatheidae, 175, 176.
Galatheidea, 174.
Gennadas, 52.
Glaucothoë peronii, 183.
,, stage, 183.
grade, Decapod, 43.
Grimaldiella, 70.
Gymnopleura, 193.

Hectarthropus, 131.
Hepomadus, 60.
Hippidea, 187.
Hippolytidae, 119.
hispida, Acanthosoma, 90.
,, Elaphocaris, 85.
hispidus, Stenopus, 133.
Homola, 189.
Hoplocaricyphus, 106.
Hoplophoridae, 106.

Iconaxiopsis, 145.
Icotopus arcurostris, 106.

Jaxea, 150.
,, nocturna, 150.

Kyptocaris, 113.

Laomedia, 156.
Laomediidae, 150.
Leander, 121.
,, serratus, 121.
Lucifer, 102.
Lysmata, 119.

Malacostracan stage, 42.
Mastigopus, 78.
,, stage, 95.
Megalopa, 183, 194.
Mesocaris, 120.
Mesomysis, 47.
Mesozoea, 47.
Metamysis, 47.
Metazoea, 47.
mülleri, Opisthocaris, 73.
Munida, 176.
Mysis stage, 43, 46.

Naupliosoma, 132.
Nauplius, 42.
Naushonia, 150.
nocturna, Jaxea, 150.
novae-zealandiae, Solenocera, 76.

Oligocaris, 113.
Oodeopus, 142.
,, serratus, 162.
Opisthocaris mülleri, 73.
ortmanni, Elaphocaris, 84.
Oxyrhyncha, 194.

Paguridea, 181.
Palaemon, 123.
Palaemonidae, 120.
Palaemoninae, 121.
Palinura, 132.
Pandacaricyphus, 113.
Pandalidae, 113.
Parapenaeus, 63, 64.
Pasiphaeidae, 111.
pectinatus, Sergestes, 95.
Penaeidae, 49.
Penaeidea, 48.
Penaeinae, 64.
Penaeopsis 67.
Periclimenes, 131.
peronii, Glaucothoë, 183.
Petalidium, 95.
,, foliaceum, 95.
Phyllosoma, 132.
Pinnotheres pisum, 195.
pisum, Pinnotheres, 195.
Platysacus crenatus, 73.
polyacantha, Euphema, 63.
Polycheles, 104.
Pontoniinae, 127.
Porcellanidae, 176.
prehensilis, Sergestes, 77.
Processa, 132.
Processidae, 131.
Protomysis, 47.
Protozoea, 43, 46.

Retrocaris, 123.
,, antarcticus, 127.
,, contraria, 123.
Richardina, 139.

Sergestes, 77.
,, cornutus, 95.
,, crassus, 94.
,, pectinatus, 95.
,, prehensilis, 77.
,, vigilax, 95.
Sergestidae, 77.
serratus, Leander, 121.
serratus, Oodeopus, 162.
Sestertius, 142.
Sicyonella, 102.
Sicyonia, 51.
Sicyoninae, 51.
siphonocera, Solenocera, 73.
Solenocera, 73.
,, siphonocera, 73.
,, novae-zealandiae, 76.
Spiropagurus, 182.
,, chiroacanthus, 182.
Spongicola, 139.
stage, Acanthosoma, 89.
,, Embryocaris, 138.
,, Entomostracan, 42.
,, Glaucothoë, 183.
,, Malacostracan, 42.
,, Mastigopus, 95.
,, Mysis, 43.
Stenopidea, 133.
Stenopus, 138.
,, hispidus, 133.
stirhynchus, Axius, 144.
stylicauda, Embryocaris, 136.
subterranea, Callianassa, 161.

telson, 44.
Thalassinidea, 142, 172.
Trachelifer, 150.
type, Eretmocaris, 115.

Upogebia danai, 165.
Upogebiinae, 164.

vigilax, Sergestes, 95

Zoea, 43, 46.
Zoontocaris, 176.

16 DEC. 1924

BRITISH MUSEUM NATURAL HISTORY Z D

Printed in England at the Oxford University Press by Frederick Hall

BRITISH MUSEUM (NATURAL HISTORY).

BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910

NATURAL HISTORY REPORT.

ZOOLOGY. VOL. VIII, No. 3. Pp. 203–306.

CRUSTACEA.

PART X.—COPEPODA.

BY

G. P. FARRAN, B.A.

WITH THIRTY-SEVEN TEXT FIGURES AND FOUR PLATES.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM
SOLD BY
[illegible], Ltd., 11 Grafton Street, New Bond Street, W.1; Dulau & Co., Ltd., 32 Old Bond Street, London, W.1; Oxford University Press, Warwick Square, London, E.C.4
Wheldon & Wesley, Ltd., 2, 3 and 4 Arthur Street, New Oxford Street, W.C.2
Oliver & Boyd, Tweeddale Court, Edinburgh
and at
The British Museum (Natural History), Cromwell Road, S.W.7
1929

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Price Ten Shillings.

[Issued 22nd June, 1929]

British Museum (Natural History).

This is No. 3 *of* 25 *copies of "Terra Nova" Zoology, Vol. VIII. Crustacea, Part X., Copepoda, printed on Special paper.*

PRESENTED

BRITISH MUSEUM NATURAL HISTORY Z D

COPEPODA.

BY G. P. FARRAN, B.A.

WITH THIRTY-SEVEN TEXT FIGURES AND FOUR PLATES

PAGE

1. Introduction 203
2 Methods 204
3. List of Stations at which Copepoda were taken 204
4. List of Species, showing the Number of Stations on which each species was recorded in each Area, with Notes on Distribution . . . 207
5. Systematic Notes and Descriptions of New Species 212
6. List of Papers referred to 300
7. Index 303

I. INTRODUCTION.

The collection of Copepoda made by the "Terra Nova" Expedition in 1910–1913 falls geographically into four groups: (1) townettings taken in the Atlantic, mainly surface gatherings, on the outward and homeward voyages, (2) a fairly comprehensive collection made in New Zealand waters in the course of the Winter Cruise in 1911, (3) a number of townettings taken from New Zealand southwards, across the course of the West Wind Drift, to the Antarctic Circle, and (4) the Antarctic gatherings.

The Atlantic records add little to our faunistic knowledge but may be of use in filling gaps when the detailed distributions of individual species come to be tabulated. The negative evidence from this area is of little value as surface townets, especially full-speed nets, did not prove on this occasion to be efficient methods of collecting Copepoda.

The New Zealand collections are probably fairly representative of the fauna of the open sea surrounding that country, and a few gatherings from the Bay of Islands supplement Kramer's and Brady's earlier accounts of the copepod fauna of the inshore waters.

In the traverse of the South Polar or West Wind Drift, and especially in a few townettings made in the neighbourhood of the Auckland and Campbell Islands, we meet with a fauna which includes several species identical with or closely allied to common forms of the North Temperate Atlantic and which will probably be found to have a circumpolar distribution.

The Antarctic species have already been investigated by several expeditions, but a few new species are here added and the range of others extended. The fact, noted by Wolfenden, that the abyssal fauna within the Antarctic from 400 metres downwards is almost identical with that of the Tropical and North Temperate Atlantic at similar depths, is fully confirmed.

Sixteen new species are described and one new variety, their names being indicated by thick type in the list of species given below.

II. METHODS.

In most cases when the gatherings were large a measured sample was examined and counted and the total numbers of each species estimated from the numbers found in the sample ; a larger sample was then looked through and the total numbers of the scarcer species estimated from their numbers in it, and finally the whole gathering or a large proportion of it was looked through less carefully and any species not previously noted were picked out.

The numbers of specimens, both mature and immature, estimated or counted, of each species taken in each gathering are given in brackets in italic figures after the Station number in the List of Species below. An asterisk indicates that only immature specimens were found in the gathering. In considering the numbers of specimens recorded it must be remembered that nets of different sizes with very varied mesh, from eighteen meshes to the inch to very fine silk, were used and that the catches of nets of different mesh cannot usefully be compared.

No attempt has been made to give a synonomy of each species, but references are given to one or two papers in which the species has been adequately figured in order to avoid uncertainty as to the species referred to.

III. LIST OF STATIONS AT WHICH COPEPODA WERE TAKEN.

For convenience the Stations have been arranged in the following areas instead of being listed consecutively :

1. North Temperate Atlantic.
2. Tropical Atlantic.
3. South Temperate Atlantic.
4. 30°–40° S. Bay of Islands.
5. 40°–50° S.
6. 50°–60° S.
7. 60°–66° 30′ S.
8. 66° 30′–76° S.
9. 76°–78° S.

Localities within these areas can be identified more closely from the charts showing the Station numbers (pls. I–IV), which are reprinted in this report, and if necessary the exact latitude and longitude or bearings can be ascertained from the List of Collecting Stations published in the Report of the expedition (Zool., Vol. II, No. 1).

In the "Net" column below Nan.=Nansen Net, F.S.=Full Speed Net, Aps.=Apstein Net, Y.f.t.=Young-fish Trawl. A numeral indicates the number of meshes to one linear inch.

North Temperate Atlantic.

Date.	No.	Metres.	Net.	Hour.	Date.	No.	Metres.	Net.	Hour.
June 19, 1910	3	0	F.S.	3–3.30 p.m.	June 29, 1910	14	0	F.S.	12.25–12.45 p.m.
„ 20 „	4	0	F.S.	6.30–6.45 p.m.	July 1 „	18	0	F.S.	4.30–4.40 a.m.
„ 22 „	6	0	F.S.	11.45 noon.	„ 1 „	19	0	F.S.	11.40 noon.
„ 25 „	8	0–25	Aps.	1 p.m.	May 27, 1913	66	0	50	1.30–2 a.m.
„ 25 „	9	0–25	Nan.	1 p.m.	„ 27 „	67	0	50	„
„ 26 „	10	0	F.S.	12.45–1 p.m.	„ 28 „	68	0	50	„
„ 27 „	11	0	F.S.	12.30–12.45 p.m.	„ 29 „	69	0	50	„
„ 28 „	13	0	F.S.	11.40 noon.	June 3 „	70	0	24	6 p.m.–8 a.m.

Tropical Atlantic.

Date.	No.	Metres.	Net.	Hour.	Date.	No.	Metres.	Net.	Hour.
July 3, 1910	23	0	F.S.	12–12.45 p.m.	May 13, 1913	56	2	50	10–11.30 a.m.
„ 4 „	25	0	F.S.	12–1 p.m.	„ 13 „	57	0	50	1.15–3 p.m.
„ 5 „	26	0	F.S.	2–2.30 p.m.	„ 16 „	58	0	50	1–1.30 a.m.
„ 7 „	29	10	F.S.	2–3.30 p.m.	„ 16 „	59	0	50	„
April 27, 1913	39	2	50	11 p.m.–1.30 a.m.	„ 17 „	61	0	50	„
„ 27 „	40	2	50	2.30–5 a.m.	„ 18 „	62	0	50	„
May 3 „	43	0	50	12.30–1 a.m.	„ 19 „	63	0	50	2–2.30 a.m.
„ 7 „	50	0	50	12.35–1.15 a.m.	„ 26 „	64	0	50	1.30–2 a.m.
„ 12 „	52	2	50	4–6 p.m.	„ 26 „	65	0	50	„
„ 12 „	53	2	50	6–7 p.m.					

South Temperate Atlantic.

Date.	No.	Metres.	Net.	Hour.	Date.	No.	Metres.	Net.	Hour.
April 21, 1913	310	Surf.	50 mesh	3.30–3.50 p.m.	April 22, 1913	311	2 m.	Y.f.t.	8–10 a.m.

30°–40° S. Off New Zealand.

Date.	No.	Metres.	Net.	Hour.	Date.	No.	Metres.	Net.	Hour.
July 16, 1911	71	4	180	11 a.m.–1 p.m.	Aug. 3, 1911	97	20	50	9 p.m.–8 a.m.
„ 17 „	72	2	50	10–10.30 a.m.	„ 4 „	98	0–45	Aps.	Noon.
„ 17 „	73	2	180	11–11.15 a.m.	„ 4 „	99	0–70	Aps.	„
„ 17 „	74	0–120	Aps.	Noon.	„ 4 „	100	0	50	1–2 p.m.
„ 17 „	75	0	50	3–3.30 p.m.	„ 4 „	101	0	50	4–5 p.m.
„ 17 „	76	0	180	„	„ 4 „	103	0	50	5–6 p.m.
„ 18 „	77	0	180	5–7 p.m.	„ 4 „	104	0–25	Aps.	4.40 p.m.
„ 21 „	78	0	50	10.30–11 a.m.	„ 4 „	105	0–80	Aps.	„
„ 21 „	79	0	50	1 p.m.	„ 4 „	106	0	50	7–8 p.m.
„ 22 „	80	0–100	24	5 p.m.	„ 4 „	107	0	24	8 p.m.–5.30 a.m.
„ 23 „	81	0–100	Nan.	9 a.m.	„ 5 „	108	0	50	Noon–4 p.m.
„ 23 „	82	0–100	Aps.	1 p.m.	„ 5 „	109	3	24	8 p.m.–8 a.m.
„ 23 „	83	2	50	1–4 p.m.	„ 6 „	110	0	24	9 p.m.–4 a.m.
„ 23 „	84	2	50	8–9 p.m.	„ 7 „	111	0	24	10 a.m.–1 p.m.
„ 24 „	85	2	50	1–5 a.m.	„ 8 „	112	3	50	Noon–4 p.m.
„ 25 „	86	3	50	8 p.m.–5 a.m.	„ 9 „	113	3	50	9 a.m.–noon.
„ 25 „	87	30	50	Noon.	„ 10 „	114	0	50	10 a.m.–4 p.m.
„ 25 „	89	0	24	8–10 p.m.	„ 16 „	116	0–50	Aps.	5.30 p.m.
„ 27 „	92	0	24	9 p.m.–4 a.m.	„ 16 „	117	0–150	Aps.	5.45 p.m.
„ 28 „	93	0	24	„	„ 17 „	118	0	50	9 p.m.–5 a.m.
„ 30 „	94	18	50	2–4 p.m.	„ 17 „	119	0	F.S.	9 a.m.–5 p.m.

30°–40° S. Off New Zealand—*continued.*

Date.	No.	Metres.	Net.	Hour.
Aug. 18, 1911	120	0	50	9 p.m.–5 a.m.
„ 19 „	122	0	50	„
„ 24 „	126	0	18	9 a.m.–noon.
„ 25 „	127	0	50	9 p.m.–5 a.m.
„ 26 „	128	0	100	9 p.m.–6 a.m.
„ 26 „	129	0	18	6 p.m.–6 a.m.
„ 27 „	130	0	18	8 p.m.–6.30 a.m.
„ 27 „	131	0	81	9 a.m.–5 p.m.
„ 29 „	132	10	50	9 a.m.–noon.
„ 30 „	133	20	18	8 p.m.–6 a.m.
Sept. 1 „	135	3	18	9 p.m.–6.30 a.m.
„ 2 „	136	0	18	„
„ 4 „	137	0	50	9 a.m.–noon.
„ 5 „	138	0	50	2–3.30 p.m.
„ 6 „	139	0	18	9 p.m.–6.30 a.m.
„ 6 „	140	0	50	10 a.m.–4 p.m.
„ 7 „	141	0	18	11 a.m.–9 a.m.
Sept. 9, 1911	143	0	50	4 p.m.–9 a.m.
„ 18 „	136	5	50	11.30 a.m.–1 p.m.
„ 24 „	147	0	F.S.	11 a.m.–4 p.m.
Aug., Sept. „	148*a*	—	Bay of Islands. New Zealand. Net 50 mesh.	
„ „	148*b*	3		
„ „	148*c*	6		
„ „	148*d*	15		
„ „	148*e*	7		
„ „	148*f*	15		
„ „	148*g*	12		
„ „	148*h*	10		
„ „	148*i*	—		
„ „	148*j*	15		
Oct. 1910	161	12	Y.f.t.	Melbourne Hbr.
July 13, 1911	202	0	F.S.	3.30 p.m.
„ 14 „	203	0	F.S.	noon.

40°–50° S.

Date.	No.	Metres.	Net.	Hour.
Nov. 30, 1910	164	0	F.S.	4 p.m.
July 11, 1911	200	0	F.S.	2 p.m.
„ 12 „	201	0	F.S.	5 p.m.
Dec. 15 „	204	0	F.S.	11 a.m.–noon.
Dec. 15, 1911	205	0	F.S.	1–4 p.m.
„ 18 „	208	0	F.S.	Noon–4 p.m.
April 2, 1912	242	10	50	10 a.m.
Mar. 14, 1913	303	0	F.S.	11 a.m.–noon.

50°–60° S.

Date.	No.	Metres.	Net.	Hour.
Dec. 15, 1910	166	0	F.S.	5 p.m.
Mar. 14, 1911	197	0	F.S.	3 p.m.
„ 17 „	198	0	100	2 p.m.
„ 17 „	199	0	180	2 p.m.
Dec. 23 „	212	0	F.S.	9 a.m.–noon.
Mar. 24, 1912	232	0	F.S.	10–11 a.m.
„ 26 „	235	10	24	7–10 p.m.
„ 27 „	236	80	24	6–8 p.m.
„ 27 „	237	10	24	Mdnt.–8 a.m.
„ 27 „	238	30	24	10–10.30 a.m.
Mar. 28, 1912	240	4	180	8.30–9 a.m.
„ 28 „	241	0	24	9 p.m.–4 p.m.
Dec. 18 „	248	0	Large F.S.	7 p.m.
„ 20 „	250	0	50	Noon–1 p.m.
„ 20 „	251	0	50	8–8.30 p.m.
„ 21 „	252	0	50	4–5 p.m.
„ 21 „	256	20	50	10 p.m.
„ 22 „	259	20	50	9 p.m.
Feb. 3, 1913	302	20	24	8.30 p.m.
Mar. 21 „	305	0	50	9–9.30 p.m.

60° S.–60° 30′ S.

Date.	No.	Metres.	Net.	Hour.
Dec. 7, 1910	167	0	F.S.	5 p.m.
„ 8 „	168	0	F.S.	4 p.m.
„ 9 „	170	0	F.S.	4 p.m.
Dec. 24, 1911	214	0	F.S.	1–4 p.m.
„ 25 „	215	0	F.S.	11 a.m.–2 p.m.
„ 27 „	216	0	F.S.	Noon–1 p.m.
Mar. 18, 1912	228	0	F.S.	9 p.m.–4 a.m.
„ 18 „	229	80	50	8.30–9 a.m.
„ 18 „	230	80	50	11 a.m.–12.30 p.m.
Dec. 26 „	264	20	50	9 p.m.
Feb. 1, 1913	298	12	24	8.30 p.m.
„ 2 „	300	0–140	24	10 p.m.

66° 30′–76° S.

Date.	No.	Metres.	Net.	Hour.
Dec. 10, 1910	172	0–400	Nan.	10 a.m.
„ 15 „	177	0–500	Nan.	11 a.m.
„ 15 „	178	0–500	24	9 p.m.
„ 22 „	180	100	24	5 p.m.
„ 24 „	182	2	180	2 a.m.
Mar. 6, 1911	195	2	50	5 p.m.
Dec. 29, 1911	217	10	50	10.30 a.m.–noon.
Jan. 9, 1912	221	10	50	1–2 p.m.
Mar. 9 „	224	1	50	7–9 p.m.
„ 11 „	225	20	50	2–4 p.m.
„ 12 „	226	10	50	9–11 a.m.
„ 15 „	227	0	F.S.	1–2 p.m.
Dec. 27 „	267	0	24	8–8.30 p.m.
„ 28 „	269	0	Y.f.t.	6–8 p.m.
„ 29 „	270	0–600	24	8 p.m.
„ 31 „	271	0	24	8 p.m.
Jan. 1, 1913	272	80	24	4 p.m.
„ 3 „	274	80	24	9 a.m.–noon.
„ 3 „	275	160	24	1–5 p.m.
„ 5 „	276	0–1750	24	10.30–11.30 p.m.
„ 6 „	281	80	24	5.30–8 p.m.
„ 7 „	282	0–1000	24	8 p.m.–8 a.m.
„ 7 „	283	88	24	1–3 p.m.
„ 8 „	284	80	24	5.15–7.30 p.m.
„ 8 „	285	0–600	24	8–10 p.m.
„ 9 „	286	10	50	11 a.m.–12.30 p.m.
„ 9 „	287	80	24	9 a.m.–7 p.m.
„ 11 „	288	60	24	8 p.m.–9 a.m.
„ 12 „	289	24	24	8 p.m.–9 a.m.
„ 12 „	290	60	24	9 a.m.–3 p.m.
„ 15 „	293	0–370	Aps.	10 a.m.

76°–78° S.

Date.	No.	Metres.	Net.	Hour.
Jan. 31, 1911	190	0	F.S.	2.30 p.m.
,, 10, 1912	222	10	50	1–2 p.m.
,, 11 ,,	223	10	50	9–11 a.m.
,, 21, 1911	313	1	24	11–11.15 a.m.
,, 28 ,,	315	5	F.S.	5.30 p.m.
,, 8, 1911	317–4	18		
,, 9 ,,	317–5	10		
,, 16 ,,	317–6	18		
,, 17 ,,	317–7	18		
,, 22 ,,	317–9	25		
,, 25 ,,	317–10	20		
Aug. 8 ,,	317–15	10		
,, 19 ,,	317–17	10		
,, 20 ,,	317–18	10		
,, 21 ,,	317–19	12		
,, 22 ,,	317–21	10		Hole in ice, various townets.
,, 24 ,,	317–22	10		
,, 25 ,,	317–23	10		
,, 27 ,,	317–24	10		
,, 28 ,,	317–25	10		
,, 31 ,,	317–27	100	Nan.	
Sept. 20 ,,	317–29	10		
,, 21 ,,	317–30	10		
,, 22 ,,	317–31	10		
Oct. 13 ,,	317–37	10		
,, 14 ,,	317–38	10		
,, 17 ,,	323–39	10		Hole in ice.
,, 20 ,,	323–41			
Oct. 21, 1911	323–43			Hole in ice.
,, 23 ,,	323–44			
Nov. 11 ,,	323–48	10		
Dec. 6 ,,	323–52	10		
,, 6 ,,	323			
Jan. 12, 1912	329	10	50	11 p.m.
,, 13 ,,	330	10	50	3–4 p.m.
,, 17 ,,	333	80	18	1–5 a.m.
,, 20 ,,	336	10	50	2 p.m.
,, 31 ,,	342	0–350	Nan.	4 p.m.
Feb. 1 ,,	343	0–600	Nan.	Noon.
,, 1 ,,	344	0–400	Nan.	3 p.m.
,, 2 ,,	345	0–500	Nan.	83.0–9.30 a.m.
,, 3 ,,	346	0–450	Nan.	9 a.m.–5 p.m.
,, 4 ,,	347	0–150	Nan.	9 a.m.–5 p.m.
Mar. 4 ,,	350	250	24	2–4 p.m.
Apr. 27 ,,	351–57	10		
,, 30 ,,	351–58	10		
May 2 ,,	351–59	10		
,, 2 ,,	351–60	30		
,, 18 ,,	351–61	10		
,, 19 ,,	351–62	30		Hole in ice.
,, 20 ,,	351–63	50		
,, 21 ,,	351–64	100		
	351–65			
	352			
Jan. 20, 1913	354	12	24	11 a.m.–2 p.m.
,, 22 ,,	357	12	24	2–6 p.m.

IV. LIST OF SPECIES, SHOWING THE NUMBER OF STATIONS ON WHICH EACH SPECIES WAS RECORDED IN EACH AREA, WITH NOTES ON DISTRIBUTION.

	North Temp. Atlantic.	Tropical Atlantic.	South Temp. Atlantic.	30°–40° S.	Bay of Islands.	40°–50° S.	50°–60° S.	60°–66° 30′ S.	66° 30′–76° S.	76°–78° S.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. *Calanus finmarchicus*	1	—	—	15	—	1	4	—	—	—
2. *C. simillimus*	—	—	—	—	—	—	13	2	—	—
3. *C. propinquus*	—	—	—	—	—	—	5	8	25	37
4. *C. minor*	10	17	—	38	2	1	—	—	—	—
5. *C. pauper*	—	—	—	1	—	—	—	—	—	—
6. *C. patagoniensis*	—	—	1	—	—	—	—	—	—	—
7. *C. carinatus*	—	2	1	19	—	—	1	—	—	—
8. *C. acutus*	—	—	—	—	—	—	4	9	21	53
9. *C. tonsus*	—	—	—	15	—	—	3	—	—	—
10. *C. vulgaris*	1	15	2	—	—	—	—	—	—	—
11. *C. Darwini*	—	1	—	33	—	—	—	—	—	—
12. *C. gracilis*	7	5	1	22	—	—	5	—	—	—
13. *C. robustior*	5	8	—	—	—	—	—	—	—	—
14. *C. tenuicornis*	2	—	—	30	3	—	1	—	—	—
15. *Eucalanus elongatus*	1	—	—	34	—	—	6	—	—	—
16. *E. attenuatus*	—	2	1	28	—	—	—	—	—	—
17. *E. subtenuis*	—	1	—	—	—	—	—	—	—	—
18. *E. mucronatus*	—	—	—	2	—	—	—	—	—	—
19. **E. acus**, n. sp.	—	—	—	—	—	—	13	1	—	—
20. *E. subcrassus*	—	2	—	—	—	—	—	—	—	—
21. *E. crassus*	1	—	—	18	—	—	—	—	—	—

	North Temp. Atlantic.	Tropical Atlantic.	South Temp. Atlantic.	30°–40° S.	Bay of Islands.	40°–50° S.	50°–60° S.	60°–66° 30′ S.	66° 30′–76° S.	76°–78° S.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
22. *Rhincalanus cornutus*	—	2	—	2	—	—	—	—	—	—
23. *R. nasutus*	1	—	—	32	—	—	—	—	—	—
24. *R. gigas*	—	—	—	—	—	—	3	5	11	4
25. *Mecynocera clausi*	2	1	1	42	2	2	—	—	—	—
26. *Paraclanus parvus*	5	3	1	29	10	2	—	—	—	—
27. *P. aculeatus*	—	12	—	1	—	—	—	—	—	—
28. *Acrocalanus longicornis*	1	11	1	—	—	—	—	—	—	—
29. *Calocalanus pavo*	2	14	1	22	—	1	—	—	—	—
30. *C. styliremis*	2	—	—	22	—	1	—	—	—	—
31. *C. plumulosus*	1	—	—	30	—	—	—	—	—	—
32. *Clausocalanus arcuicornis*	10	10	2	49	8	5	10	—	—	—
33. *C. pergens*	3	—	—	15	1	1	—	—	—	—
34. *C. paululus*	—	—	—	14	—	1	—	—	—	—
35. **C. laticeps**, n. sp.	—	—	—	—	—	—	11	2	—	—
36. *C. furcatus*	7	18	2	—	—	—	—	—	—	—
37. *Clenocalanus vanus*	—	2	—	35	8	1	4	6	5	44
38. *Microcalanus pygmæus*	—	—	—	—	—	—	—	—	—	6
39. *Stephus longipes*	—	—	—	—	—	—	—	—	—	15
40. *Spinocalanus abyssalis*	—	—	—	—	—	—	—	—	6	—
41. *S. magnus*	—	—	—	—	—	—	—	—	6	—
42. *S. spinosus*	—	—	—	—	—	—	—	—	1	—
43. *Ætideus armatus*	—	—	—	2	—	—	1	—	—	—
44. *A. Giesbrechti*	—	—	—	4	—	—	—	—	—	—
45. **A. acutus**, n. sp.	—	—	—	3	—	—	—	—	—	—
46. *Chiridius Poppei*	—	—	—	1	—	—	—	—	—	—
47. *C. gracilis*	—	—	—	1	—	—	—	—	—	—
48. *C. polaris*	—	—	—	—	—	—	—	—	1	—
49. *C. antarcticus*	—	—	—	—	—	—	—	—	—	4
50. *C. minor*	—	—	—	—	—	—	—	—	4	—
51. *Gaidius tenuispinus*	—	—	—	—	—	—	—	—	5	—
52. *G. intermedius*	—	—	—	—	—	—	—	—	2	—
53. *Drepanopsis frigidus*	—	—	—	—	—	—	—	—	2	—
54. *Pseudochirella notacantha*	—	—	—	—	—	—	—	—	2	—
55. *Gætanus minor*	—	—	—	2	—	—	—	—	—	—
56. *G. antarcticus*	—	—	—	—	—	—	—	—	1	—
57. *Undeuchæta minor*	3	2	—	12	—	—	5	—	—	—
58. *U. major*	—	1	—	—	—	—	—	—	1	—
59. *Chirundina Streetsi*	—	—	—	1	—	—	—	—	—	—
60. *Euchirella rostrata*	—	—	—	16	—	—	2	—	—	—
61. *E. brevis*	—	—	—	3	—	—	—	—	—	—
62. **E. latirostris**, n. sp.	—	—	—	—	—	—	1	—		—
63. *E. rostromagna*	—	—	—	—	—	—	—	—	5	—
64. *E. venusta*	—	—	—	3	—	—	—	—	—	—
65. *E. hirsuta*	—	—	—	—	—	—	—	—	1	—
66. *Euchæta marina*	6	5	1	—	—	—	—	—	—	—
67. *E. acuta*	—	—	—	19	—	—	—	—	—	—
68. *E. media*	—	—	—	18	—	—	—	—	—	—
69. *E. pubera*	—	—	—	10	—	—	—	—	—	—
70. *E. longicornis*	—	—	—	1	—	—	—	—	—	—
71. *Pareuchæta antarctica*	—	—	—	—	—	—	—	—	14	23
72. *P. similis*	—	—	—	—	—	—	—	—	—	7
73. **P. Erebi**, n. sp.	—	—	—	—	—	—	—	—	—	3
74. *P. Farrani*	—	—	—	—	—	—	—	—	1	—
75. **P. rasa**, n. sp.	—	—	—	—	—	—	—	—	—	—
76. **P. biloba**, n. sp.	—	—	—	—	—	—	4	—	1	—
77. *Scolecithrix Danæ*	5	13	1	5	—	—	—	—	—	—
78. *S. Bradyi*	—	—	—	2	—	—	—	—	—	—
79. *S. polaris*	—	—	—	—	—	—	—	—	2	—
80. *S. valida*	—	—	—	—	—	—	—	—	1	—
81. **S. incisa**, n. sp.	—	—	—	—	—	—	—	—	—	1
82. *S. robusta*	—	—	—	—	—	—	—	—	1	—

	North Temp. Atlantic.	Tropical Atlantic.	South Temp. Atlantic.	30°–40° S.	Bay of Islands.	40°–50° S.	50°–60° S.	60°–66° 30′ S.	66° 30′–76° S.	76°–78° S.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
83. *S. ovata*	—	—	—	1	—	—	—	—	5	—
84. *Scolecithricella dentata*	1	4	—	6	—	—	—	—	—	—
85. *S. minor*	1	1	—	—	—	—	—	—	—	—
86. *S. glacialis*	—	—	—	—	—	—	3	1	1	—
87. *S. vittata*	—	—	—	1	—	—	—	—	—	—
88. *Scaphocalanus affinis*	—	—	—	—	—	—	—	—	2	—
89. *S. brevicornis*	—	—	—	—	—	—	—	—	6	—
90. *S. sub-brevicornis*	—	—	—	—	—	—	—	—	2	—
91. *S. echinatus*	—	—	—	1	—	—	3	—	—	—
92. *S. curtus*	—	—	—	4	—	—	—	—	—	—
93. *Racovitzanus antarcticus*	—	—	—	—	—	—	1	—	6	1
94. *Scottocalanus securifrons*	—	—	—	2	—	—	—	—	—	—
95. **S. terranovæ**, n. sp.	—	—	—	5	—	—	—	—	—	—
96. **Amallophora altera**, n., sp.	—	—	—	—	—	—	—	—	2	—
97. *Lophothrix* sp.	—	—	—	1	—	—	—	—	1	—
98. *L. latipes*	—	—	—	4	—	—	—	—	—	—
99. *Cephalophanes frigidus*	—	—	—	—	—	—	—	—	1	—
100. *Xanthocalanus*, sp.	—	—	—	—	—	—	—	—	2	—
101. *Phœnna spinifera*	—	—	—	3	—	—	—	—	—	—
102. *Centropages violaceus*	4	11	1	1	—	—	—	—	—	—
103. *C. furcatus*	—	3	—	—	—	—	—	—	—	—
104. *C. Bradyi*	—	—	—	7	—	—	—	—	—	—
105. *C. aucklandicus*	—	—	—	1	2	1	—	—	—	—
106. *Temoropia mayumbœnsis*	—	—	—	1	—	—	—	—	—	—
107. *Temora stylifera*	—	8	—	—	—	—	—	—	—	—
108. *T. turbinata*	—	—	—	55	6	1	2	—	—	—
109. *Metridia lucens*	—	—	—	—	—	—	9	2	5	—
110. *M. princeps*	—	—	—	—	—	—	—	—	1	—
111. *M. Gerlachei*	—	—	—	—	—	—	2	4	20	48
112. *M. curticauda*	—	—	—	—	—	—	—	—	4	—
113. *Pleuromamma abdominalis*	5	6	—	29	—	—	1	—	—	—
114. *P. xiphias*	—	—	—	8	—	—	—	—	—	—
115. *P. robusta*	—	—	—	—	—	—	4	—	—	—
116. *P. gracilis*	3	5	—	16	—	—	3	—	—	—
117. **P. Piseki**, n. sp.	2	6	—	20	—	—	—	—	—	—
118. *P. borealis*	—	—	—	—	—	—	3	—	—	—
119. *Lucicutia flavicornis*	4	2	—	24	—	—	—	—	—	—
120. *L. gemina*	—	—	—	2	—	—	—	—	—	—
121. *L. Clausi*	—	—	—	2	—	—	—	—	—	—
122. *L. ovalis*	2	—	—	6	—	—	—	—	—	—
123. *L. curta*	—	—	—	—	—	—	—	—	1	—
124. *L. magna*	—	—	—	—	—	—	—	—	2	—
125. *L. grandis*	—	—	—	—	—	—	—	—	1	—
126. *Heterorhabdus spinifrons*	—	—	—	3	—	—	—	—	—	—
127. *H. papilliger*	2	3	—	19	—	—	—	—	—	—
128. *H. austrinus*	—	—	—	—	—	—	—	—	10	—
128*a*. *H. austrinus*, var.	—	—	—	—	—	1	5	1	2	—
129. **H. pustulifer**, n. sp.	—	—	—	—	—	—	—	—	2	—
130. *H. robustus*	—	—	—	—	—	—	—	—	5	—
131. *H. compactus*	—	—	—	—	—	—	—	—	2	—
132. *Heterostylites major*	—	—	—	—	—	—	—	—	1	—
133. *H. longicornis*	—	1	—	—	—	—	—	—	—	—
134. *Haloptilus acutifrons*	1	—	—	10	—	—	—	—	—	—
135. *H. oxycephalus*	—	—	—	—	—	—	2	1	7	1
136. *H. ocellatus*	—	—	—	—	—	—	—	—	11	—
137. *H. spiniceps*	1	—	—	5	—	—	—	—	—	—
138. *H. mucronatus*	—	—	—	4	—	—	—	—	—	—
139. *H. longicornis*	—	—	—	7	—	—	—	—	—	—
140. *Augaptilus longicaudatus*	—	—	—	2	—	—	—	—	—	—
141. *Euaugaptilus hecticus*	—	—	—	1	—	—	—	—	—	—
142. *E. filigerus*	—	—	—	1	—	—	—	—	—	—

	North Temp. Atlantic.	Tropical Atlantic.	South Temp. Atlantic.	30°–40° S.	Bay of Islands.	40°–50° S.	50°–60° S.	60°–66° 30′ S.	66° 30′–76° S.	76°–78° S.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
143. *E. laticeps*	—	—	—	—	—	—	—	—	2	—
144. *Arietellus setosus*	—	—	—	3	—	—	—	—	—	—
145. *A. aculeatus*	—	—	—	1	—	—	—	—	—	—
146. *Candacia longimana*	—	—	—	12	—	—	—	—	—	—
147. **C. falcifera**, n. sp.	—	—	—	—	—	—	—	—	4	—
148. *C. æthiopica*	3	2	—	21	—	—	—	—	—	—
149. *C. pachydactyla*	—	11	—	—	—	—	—	—	—	—
150. *C. curta*	—	6	—	—	—	—	—	—	—	—
151. *C. bispinosa*	3	3	—	4	—	—	—	—	—	—
152. *C. bipinnata*	1	1	—	25	—	—	—	—	—	—
153. *C. varicans*	1	—	—	6	—	—	—	—	—	—
154. *C. simplex*	—	2	—	7	—	—	—	—	—	—
155. *C. cheirura*	—	—	—	—	—	—	4	—	—	—
156. *Calanopia Aurivillii*	—	—	—	1	—	—	—	—	—	—
157. *C. americana*	—	3	—	—	—	—	—	—	—	—
158. *Labidocera acutifrons*	—	1	—	—	—	—	—	—	—	—
159. *L. Nerii*	—	4	—	—	—	—	—	—	—	—
160. *L. Cervi*	—	—	—	4	2	—	—	—	—	—
161. **L. brasiliense**, n.sp.	—	1	—	—	—	—	—	—	—	—
162. *Pontella securifer*	—	3	—	—	—	—	—	—	—	—
163. **Pontella novæ-zelandiæ**, n. sp.	—	—	—	9	—	—	—	—	—	—
164. *Pontellopsis regalis*	—	1	—	—	—	—	—	—	—	—
165. *P. perspicax*	—	5	—	—	—	—	—	—	—	—
166. *P. brevis*	—	2	—	—	—	—	—	—	—	—
167. *Pontellina plumata*	1	11	—	8	—	—	—	—	—	—
168. *Paralabidocera antarctica*	—	—	—	—	—	1	—	—	1	8
169. *Acartia Clausi*	3	1	—	15	9	2	1	—	—	—
170. *A. negligens*	8	5	2	3	—	1	—	—	—	—
171. *A. Danæ*	1	2	—	47	2	—	1	—	—	—
172. *Oithona plumifera*	2	14	—	32	5	1	7	—	—	—
173. *O. tenuis*	—	1	—	2	—	—	—	—	—	—
174. *O. setigera*	—	1	—	4	—	—	—	—	—	—
175. *O. frigida*	—	—	—	—	—	—	—	—	3	15
176. *O. similis*	—	1	—	21	4	1	12	8	3	45
177. *Ratania atlantica*	—	—	—	—	—	—	—	—	2	—
178. *Oncæa venusta*	5	15	2	40	1	—	—	—	—	—
178*a*. *O. venusta* var. **venella**, nov.	2	6	1	6	—	—	—	—	—	—
179. *O. media*	4	14	1	25	5	1	—	—	—	1
180. *O. mediterranea*	2	3	—	20	1	—	3	—	—	—
181. *O. conifera*	—	—	—	12	1	—	—	2	1	3
182. *O. dentipes*	—	—	—	1	—	—	—	—	—	—
183. *O. subtilis*	1	—	—	—	—	—	—	—	—	—
184. *O. curvata*	—	—	—	—	—	—	1	2	1	33
185. *Lubbockia*, sp.	—	—	—	—	—	—	—	—	1	—
186. *Sapphirina ovato lanceolata*	1	—	—	3	—	—	—	—	—	—
187. *S. gemma*	—	—	—	1	—	—	—	—	—	—
188. *S. salpæ*	—	—	1	9	—	—	—	—	—	—
189. **S. sali**, n. sp.	—	—	—	9	—	—	—	—	—	—
190. *S. angusta*	—	—	—	18	—	—	—	—	—	—
191. *S. vorax*	—	—	—	2	—	—	—	—	—	—
192. *S. pyrosomatis*	—	2	—	—	—	—	—	—	—	—
193. *S. auronitens*	—	2	—	6	—	—	—	—	—	—
194. *S. scarlata*	—	—	—	4	—	—	—	—	—	—
195. *S. nigromaculata*	—	3	—	—	—	—	—	—	—	—
196. *S. bicuspidata*	—	1	—	—	—	—	—	—	—	—
197. *S. intestinata*	—	—	—	1	—	—	—	—	—	—
198. *S. maculosa*	—	—	—	1	—	—	—	—	—	—
199. *S. opalina*	—	3	—	9	—	—	—	—	—	—
200. *S. metallina*	—	—	—	1	—	—	—	—	—	—
201. *Copilia vitrea*	—	—	—	9	—	—	—	—	—	—
202. *C. mirabilis*	—	7	—	—	—	—	—	—	—	—

	North Temp. Atlantic.	Tropical Atlantic.	South Temp. Atlantic.	30°–40° S.	Bay of Islands.	40°–50° S.	50°–60° S.	60°–66° 30′ S.	66° 30′–76° S.	76°–78° S.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
203. *C. Hendorffii*	—	—	—	15	—	—	—	—	—	—
204. *C. quadrata*	—	1	—	1	—	—	—	—	—	—
205. *C. lata*	—	4	—	—	—	—	—	—	—	—
206. *Corycæus speciosus*	3	12	1	3	—	—	—	—	—	—
207. *C. Clausi*	2	2	—	—	—	—	—	—	—	—
208. *C. crassiusculus*	—	—	—	21	—	—	—	—	—	—
209. *C. typicus*	4	3	—	—	—	—	—	—	—	—
210. *C. flaccus*	6	4	—	22	—	—	—	—	1	—
211. *C. limbatus*	—	—	—	3	—	—	—	—	—	—
212. *C. longistylis*	—	—	—	13	—	—	—	—	—	—
213. *C. lautus*	4	1	—	7	—	—	—	—	—	—
214. *C. furcifer*	—	—	—	13	—	—	—	—	—	—
215. **C. inuncus**, n. sp.	—	—	—	28	9	2	—	—	—	(1)
216. *C. Giesbrechti*	4	8	1	—	—	—	—	—	—	—
217. *C. latus*	1	13	—	—	—	—	—	—	—	—
218. *C. ovalis*	1	—	—	—	—	—	—	—	—	—
219. *C. amazonicus*	—	3	—	—	—	—	—	—	—	—
220. *Corycella gracilis*	6	15	—	—	—	1	—	—	—	1
221. *C. rostrata*	6	4	1	18	1	1	—	—	—	—
222. *Microsetella rosea*	—	1	—	6	1	1	—	—	—	—
223. *M. norvegica*	1	—	—	—	—	1	1	1	—	—
224. *Euterpe acutifrons*	2	—	—	4	6	1	—	—	—	—
225. *Setella gracilis*	—	6	—	5	—	—	—	—	—	—
226. *Miracia efferata*	2	12	—	1	—	—	—	—	—	—
227. *Clytemnestra scutellata*	—	—	—	1	—	—	—	—	—	—
228. *Harpacticus furcifer*	—	—	—	—	—	—	—	—	1	1
229. *Idya tenuimana*	—	—	—	—	—	—	—	—	—	1
230. *I. racovitzai*	—	—	—	—	—	—	—	2	—	—
231. *I. furcata*	—	—	—	—	5	—	—	—	—	—

The North Atlantic species numbered sixty, taken in sixteen hauls, of which fourteen were at the surface. These were all widespread species and obviously only formed a small proportion of the total fauna. The Tropical Atlantic species numbered eighty-one, taken in nineteen hauls, of which thirteen were at the surface and six between 0 and 10 metres. Three of the Tropical Stations (Nos. 39, 40, and 43), situated off the coast of South America, call for mention, as on them several species were taken which did not occur elsewhere in the Atlantic. Of these species three, viz. *Calanopia americana*, *Labidocera brasiliense*, n. sp., and *Corycæus amazonicus* seem to be confined to the west side of the Atlantic.

In the South Temperate Atlantic twenty-one species were taken in two hauls, the only species amongst them with a limited distribution being *Calanus patagoniensis*.

In the waters round New Zealand (30°–40° S.), chiefly to the north of North Island, 127 species occurred in sixty-three hauls, thirty-six being surface hauls and the remainder between 2 and 150 metres. These species were almost all widespread forms, those with a limited distribution being *Labidocera Cervi*, *Copilia Hendorffii* and probably the newly-described species *Ætideus acutus*, *Scottocalanus terranovæ*, *Pontella novæ-zelandiæ*, *Sapphirina sali*, and *Corycæus inuncus*. The eight additional hauls between 40° and 50° S. only added four more species, two of them *Heterorhabdus austrinus* and *Paralabidocera Hodgsoni* being Antarctic forms, probably drifted.

In the Bay of Islands in ten hauls at various depths down to 15 metres, twenty-three species were taken, only one of them, *Idya furcata*, being an addition to the 127 species referred to above.

Between 50° and 60° S. forty species were taken in twenty hauls, twelve being surface hauls and the remainder at various depths down to 80 metres. Twenty-two of these species are New Zealand forms whose range extends southwards, eight are Antarctic and the remainder form an interesting group of ten species which belong properly neither to New Zealand nor to the Antarctic and seem to represent the fauna of the West Wind Drift with a probable circumpolar range. Three of these species, *Metridia lucens*, *Pleuromamma robusta*, and *Pleuromamma borealis*, also occur in the North Atlantic, one, *Candacia cheirura*, has been described from South Africa, one, *Heterorhabdus* sp., is a small form of an Antarctic species, one, *Calanus simillimus*, is a well-known subarctic form and four, *Eucalanus acus*, *Clausocalanus laticeps*, *Euchirella latirostris*, and *Pareuchæta biloba*, are described as new.

Between 60° and 60° 30′ S. in twelve hauls, seven at the surface and the remainder between 12 and 140 metres, seventeen species were taken, all belonging either to the West Wind Drift or to the Antarctic; one, *Idya racovitzai*, being an Antarctic species which was not taken further south.

From within the Antarctic Circle eighty-seven hauls were examined. Of these five were surface hauls, thirty-eight were made under the ice and amongst the remainder were several very deep vertical hauls, the deepest reaching 1750 metres. The Antarctic hauls yielded seventy-one species. Of these thirty-one were cosmopolitan species, mainly from deep or very deep water, thirty-five were Antarctic species which have their headquarters within or close to the Antarctic Circle, three were immature or doubtfully identified and three are based on single records of species which may have come from accidentally contaminated townettings or else have been drifted into the area.

V. SYSTEMATIC NOTES AND DESCRIPTIONS OF NEW SPECIES.

1. *Calanus finmarchicus* (Gunner), Fig. 1.

Calanus helgolandicus G. O. Sars, 1903.

Occurrence.—Only taken at one station in the Tropical Atlantic, at the Azores. Frequent, on one station common, from New Zealand southwards to the Auckland and Campbell Islands. Common in Melbourne Harbour.

Remarks.—The specimens from the Azores measured only, ♀, 2·7–2·8 mm., ♂, 2·7 mm. The females of these specimens had 27–28 teeth on the incurved inner margins of the first basals of the fifth feet.

The specimens from the southern hemisphere differed from the normal North Temperate Atlantic form in their smaller size and the reduced number of teeth on the first basals of the fifth feet. Females from 30°–40° S. measured 2·64–3·0 mm., average 2·75 mm., males 2·68–3·0 mm., the females having an average of 17–18 teeth on the fifth feet basals. Six specimens taken at random had, on the right and left fifth feet, teeth numbering 18+15, 11+13, 19+22, 19+17, 24+17, 21+21. The specimens from 40°–50° S. (Stn. 242) measured, ♀, 2·7 mm. with 15–18 teeth (fig. 1), and those from 50°–60° S., ♀, 2·88–3·10 mm., with an average of 16–17 teeth.

It seems evident from these few measurements that although the Northern and Southern forms overlap in size the latter might be regarded as a distinct race both on account of their small size and because of the small number of teeth on the fifth feet. The normal number of teeth in North Atlantic specimens is over 30. Ten specimens, females, measuring 3·18–3·2 mm., from one haul on the South Coast of Ireland gave an average of 33·5 teeth both on the right and left sides, the extremes being 27–40 on the right and 26–39 on the left.

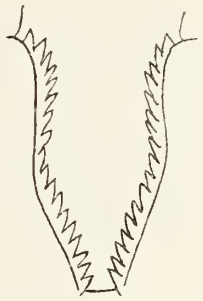

Fig. 1.—*Calanus finmarchicus*. Female from Stn. 242; denticulation on inner margins of first basal joints of fifth feet.

If, as some think, the distinction between the large *Calanus finmarchicus* and the smaller *C. helgolandicus* should be maintained, it would also be reasonable to give a separate name to the southern form, but probably, as the Azores specimens indicate, further investigation will show that there is a complete gradation from one form to the other.

Records.—North Temperate Atlantic: 70 (*86*). **30°–40°** S.: 83 (*1*), 100 (*2*), 107 (*14*), 109 (*72*), 110 (*6*), 112 (*1*), 114 (*37*), 118 (*1*), 120 (*60*), 126 (*2*), 127 (*31*), 130 (*1*), 131 (*1*), 132 (*6*), 161 (*800*).—**40°–50°** S.: 242 (*300*).—**50°–60°** S.: 235 (*6*), 236 (*1*), 238 (*9*), 241 (*6*).

2. *Calanus simillimus* Giesbr.

Calanus simillimus Giesbrecht, 1902; *Calanus propinquus* Giesbrecht, 1892.

Occurrence.—Frequent to the south of New Zealand between 50° and 60° S. and on two stations south of 60° S.

Remarks.—Length, ♀, 3·2–3·6 mm.; specimens from stations south of 60° only measured 2·8–3·2 mm. The area of this species overlapped that of *Calanus propinquus*, but the smaller size and more slender form of *C. simillimus* makes its recognition easy. Wolfenden (1908) has recorded this species as common in the "Discovery" collections between 50° 48′ S. and 59° 19′ S.,and on one station in 84° S., and (1911) as less common in the "Gauss" Antarctic collections.

Records.—**50°–60°** S.: 232 (*85*), 235 (*2*), 236 (*7*), 238 (*14*), 241 (*1*), 248 (*50*), 250 (*300*), 251 (*44*), 252 (*10*), 256 (*36*), 259 (*65*), 302 (*2340*), 305 (*11,200*).—**60°–66° 30′** S.: 167 (*22*), 228 (*1*).

3. *Calanus propinquus* Brady.

Calanus propinquus Giesbrecht, 1902.

Occurrence.—One of the most characteristic and plentiful of the Antarctic copepods, though not so abundant as *Calanus acutus*. It occurred on almost every station within the Antarctic circle, adults, mainly females, being common between 66° 30′ and 76° S., but scarce under the ice south of 76° S. North of 66° 30′ very few adults were found though the younger stages were abundant on several stations. The most northern point at which an adult female was taken was 54° 38′ S.

Remarks.—Length, ♀, 5·3–5·5 mm. The robust form of the female and the low cephalon, sloping back from the base of the rostrum without a trace of vaulting, are characteristic. The second to fourth larval stages can be recognised by the abnormally long antennules which, when adpressed, are longer than the whole animal by about the last six joints. In the fifth stage the antennæ are longer by about three joints.

The actual measurements are as follows :

Stage	V.	length	4·4	mm.	1st Ant.	extends	0·72	mm. beyond furca.	Th. 5 acute.
,,	IV.	,,	3·2	,,	,,	1·30	,,	,,	,, acute.
,,	III.	,,	2·2	,,	,,	1·08	,,	,,	,, rounded.
,,	II.	,,	1·4	,,	,,	0·92	,,	,,	,, rounded.

In *Calanus gracilis*, whose range slightly overlaps that of *C. propinquus*, Stages IV and V have much longer first antennæ, exceeding the body by more than nine-tenths of its length.

Records.—**50°–60°** S. : 198 (*1**), 212 (*28**), 252 (*10,000**), 256 (*1000*), 259 (*840**). —**60°–66° 30′** S. : 215 (*1**), 216 (*1**), 228 (*880**), 229 (*10**), 230 (*770**), 264 (*160**), 298 (*3**), 300 (*1030*).—**66° 30′–76°** S. : 172 (*18*), 177 (*6*), 180 (*100*), 182 (*1*), 195 (*25**), 217 (*31*), 221 (*3**), 224 (*52*), 267 (*150*), 269 (*300*), 270 (*85*), 271 (*4*), 272 (*76*), 274 (*387*), 275 (*95*), 281 (*143*), 283 (*30*), 284 (*556*), 285 (*130*), 286 (*3*), 287 (*23*), 288 (*40*), 289 (*181*), 290 (*172*), 293 (*2*).—**76°–78°** S. : 317 [4 (*5**), 5 (*3**), 6 (*4**), 7 (*35*), 9 (*1**), 10 (*2**), 11 (*57**), 15 (*2**), 17 (*1**), 18 (*4*), 19 (*1**), 21 (*5*), 22 (*15**), 23 (*5*), 24 (*9**), 29 (*11*), 30 (*2**), 31 (*3**), 37 (*1**), 38 (*5*)], 323 [39 (*2**), 41 (*2*), 44(*2**)], 342 (*2**), 344 (*3*), 345 (*3**), 347 (*2**), 350 (*4*), 351 [57 (*3**), 59 (*4**), 60 (*70**), 61 (*50**), 62 (*99**), 64 (*120*), 65 (*120**)], 352 (*5**), 357 (*8**).

4. *Calanus minor* (Claus).

Calanus minor Giesbrecht, 1892.

Occurrence.—Taken in abundance in the Atlantic in tropical and sub-tropical oceanic waters. Common off North Island, New Zealand, as far as 40° 12′ S.

Remarks.—Length, ♀, 1·56–2·05 mm. A considerable variation in the size of the females, from 1·56 to 1·9 mm., was noted on some of the New Zealand stations, *e.g.* 81, 85, and 86, but the average size was 1·8–1·9 mm.

Records.—N. Temp. Atlantic : 8 (*2**), 9 (*6**), 11 (*2**), 18 (*22*), 19 (*1*), 66 (*710*),

67 (*212*), 68 (*2320*), 69 (*1*), 70 (*8*).—Trop. Atlantic : 39 (*280*), 40 (*150*), 43 (*90*), 50 (*1278*), 52 (*29*), 53 (*100*), 56 (*890*), 57 (*3160*), 58 (*57*), 59 (*520*), 61 (*820*), 62 (*720*), 63 (*640*), 64 (*920*), 65 (*860*), 310 (*1580*), 311 (*52*).—**30°–40°** S. : 71 (*6*), 72 (*16*), 75 (*4*), 76 (*10*), 78 (*1*), 81 (*40*), 82 (*2*), 83 (*76*), 84 (*300*), 85 (*1170*), 86 (*1600*), 87 (*85*), 89 (*1*), 92 (*2*), 93 (*16*), 97 (*8*), 98 (*1**), 99 (*1**), 100 (*6*), 101 (*1*), 103 (*1**), 106 (*70*), 107 (*174*), 109 (*35*), 110 (*1*), 112 (*93*), 114 (*610*), 118 (*408*), 119 (*20*), 120 (*2660*), 122 (*1*), 126 (*2*), 127 (*5125*), 128 (*960*), 129 (*2*), 130 (*16*), 131 (*30*), 132 (*1100*), 148 [i (*3*), j (*1*)].—**40°–50°** S. : 210 (*2*).

5. *Calanus pauper* Giesbr.

Calanus pauper Giesbrecht, 1892.

Occurrence.—One specimen, a male, was taken in a surface haul about twenty miles west of Cape Maria van Diemen, New Zealand.

Remarks.—Length, ♂, 2·04 mm. The male is easily recognised by the way in which the left fifth foot projects laterally at right angles to the body. It is not improbable that some females have been overlooked amongst the numerous specimens of *C. minor*.

Record.—**30°–40°** S. : 120 (*1*).

6. *Calanus patagoniensis* (Brady).

Calanus patagoniensis Giesbrecht, 1892.

Occurrence.—One female was taken off Rio de Janeiro.

Remarks.—Length, ♀, 2·6 mm. In appearance it much resembles a small *C. finmarchicus*, but it can be readily distinguished by the absence of denticulations on the inner edge of the first basals of the fifth feet.

Record.—Tropical Atlantic : 40 (*1*).

7. *Calanus carinatus* Kröyer.

Calanus brevicornis Giesbrecht, 1892.

Occurrence.—In the Atlantic it was only taken on the western side ; off Rio de Janeiro, where it was plentiful, and in 36° 57′ S., one specimen. Off New Zealand it occurred in very small numbers on several stations.

Remarks.—Length, ♀, Atlantic specimens, 2·36–2·82 mm., New Zealand specimens, 3·06–3·6 mm. With (1915), who re-examined Kröyer's type, considered it to be the same as *C. brevicornis* as figured by Giesbrecht.

Records.—Tropical Atlantic : 39 (*200*), 40 (*375*).—South Temp. Atlantic : 310 (*1*), —**30°–40°** S. : 92 (*1*), 93 (*1*), 100 (*2*), 101 (*1*), 109 (*29*), 111 (*1*), 114 (*7**), 120 (*7*), 126 (*2*), 128 (*1*), 129 (*1*), 130 (*2*), 131 (*3*), 132 (*20*), 133 (*2*), 135 (*1*), 136 (*3*), 138 (*1*), 140 (*3*).—**50°–60°** S. : 237 (*1** dead spec.).

8. *Calanus acutus* Giestr.

Calanus acutus Giesbrecht, 1902.

Occurrence.—This is the most characteristic antarctic copepod in the collection, being more plentiful than either *Calanus propinquus* or *Metridia Gerlachei*. The few specimens from north of 60° S. appeared to have been dead when taken and the most northerly point from which it can definitely be recorded as living is in 61° 22′ S. It occurred in large numbers in the hauls made under the ice in Winter Quarters off Cape Evans.

Remarks.—The young stages can be distinguished from those of other species of *Calanus* by their transparency and their well-vaulted cephalon.

Records.—**50°–60°** S.: 197 (*1**), 198 (*3**), 256 (*3*), 302 (*20*).—**60°–66° 30′** S.: 167 (*53*), 215 (*50*), 216 (*300*), 228 (*29*), 229 (*2*), 230 (*71*), 264 (*136*), 298 (*27*), 300 (*19,900*). —**66° 30′–76°** S.: 172 (*48*), 177 (*51*), 180 (*670*), 182 (*3*), 195 (*800*), 225 (*35*), 267 (*82*), 269 (*145*), 270 (*1650*), 271 (*5*), 272 (*700*), 274 (*2100*), 275 (*2200*), 281 (*1410*), 283 (*293*), 284 (*43*), 287 (*16*), 288 (*292*), 289 (*11*), 290 (*364*), 293 (*28*). —**76°–78°** S.: 222 (*1*), 223 (*3*), 313 (*110*), 315 (*32*), 317 [4 (*20**), 5 (*12**), 6 (*76**), 7 (*355*), 9 (*25**), 10 (*20**), 11 (*1950*), 15 (*1760*), 17 (*7**), 18 (*83*), 19 (*69**), 21 (*140*), 22 (*400*), 23 (*120*), 24 (*210*), 25 (*70*), 29 (*124**), 30 (*122*), 31 (*28*), 37 (*12*), 38 (*29**)], 323 [39 (*62*), 41 (*14*), 43 (*6*), 44 (*7*), 48 (*10*)], 325 (*88**), 329 (*1*), 330 (*9**), 333 (22), 336 (*3*), 342 (*1750*), 343 (*1**), 344 (*104*), 345 (*725*), 346 (*447*), 347 (*1123*), 351 [57 (*2**), 58 (*22**), 59 (*130**), 60 (*140**), 61 (*940**), 62 (*1562**), 63 (*3000*), 64 (*2000*), 65 (*1400*)], 352 (*130**), 354 (*20*), 357 (*134*).

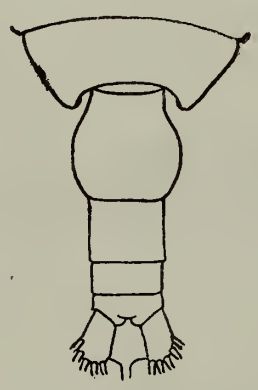

Fig. 2.—*Calanus tonsus*. Female: abdomen, dorsal view, × 47.

9. *Calanus tonsus* Brady. Fig. 2.

Calanus tonsus Brady, 1883.

Occurrence.—Frequent on stations off New Zealand, reaching to 54° 33′ S.

Remarks.—Length, ♀, 3·48–3·6 mm. The inflated genital segment of the female, as seen in dorsal view (fig. 2), affords a ready means of recognition.

Records.—**30°–40°** S.: 108 (*5*), 109 (*2*), 112 (*1**), 120 (*10*), 122 (*2*), 126 (*2*), 127 (*215*), 129 (*2*), 130 (*39*), 131 (*53*), 133 (*2*), 135 (*3*), 136 (*1*), 139 (*45*), 143 (*6*).—**50°–60°** S.: 238 (*39*), 241 (*11**), 252 (*2*).

10. *Calanus vulgaris* (Dana).

Calanus vulgaris Giesbrecht, 1892.

Occurrence.—Abundant in the Tropical Atlantic.

Records.—North Temp. Atlantic: 67 (*3*).—Tropical Atlantic.—39 (*360*), 40 (*95*), 43 (*180*), 50 (*72*), 52 (*21*), 53 (*740*), 56 (*13*), 57 (*20*), 58 (*209*), 59 (*980*), 61 (*1080*), 62 (*110*), 63 (*260*), 64 (*31*), 65 (*19*).—South Temp. Atlantic: 310 (*59*), 311 (*12*).

11. *Calanus Darwini* (Lubb.).

Calanus Darwini Giesbrecht, 1892.

Occurrence.—Frequent off New Zealand. In the Atlantic only one specimen, from off Rio de Janeiro, was taken.

Remarks.—Length, ♀, 2·1–2·5 mm., ♂, 1·9–2·1 mm. Its apparent absence over most of the Atlantic is remarkable.

Records.—Tropical Atlantic: 40 (*1*).—30°–40° S.: 71 (*1*), 72 (*1*), 75 (*12*), 76 (*5*), 83 (*8*), 84 (*6*), 85 (*90*), 86 (*120*), 87 (*5*), 92 (*21*), 93 (*563*), 100 (*1*), 101 (*1*), 106 (*7*), 109 (*2*), 112 (*4*), 114 (*10*), 118 (*1*), 120 (*17*), 126 (*1*), 127 (*255*), 128 (*30*), 130 (*2*), 131 (*57*), 132 (*70*), 133 (*28*), 135 (*4*), 136 (*2*), 137 (*60*), 139 (*2*), 143 (*3*), 145 (*25*), 147 (*1*).

12. *Calanus gracilis* Dana.

Calanus gracilis Giesbrecht, 1892.

Occurrence.—This widespread species was common over the whole area traversed to 52° 41′ S. where its range meets that of *Calanus propinquus*.

Remarks.—Length, ♀, 3·36–3·48 (North Temp. Atlantic), 3·35–3·75 (off New Zealand), 4·2–4·44 (50°–60° S.).

Records.—North Temp. Atlantic: 9 (*2**), 11 (*1*), 66 (*110*), 67 (*28*), 68 (*140*), 69 (*17*), 70 (*6*).—Tropical Atlantic: 50 (*10*), 53 (*26*), 62 (*1*), 64 (*57*), 65 (*90*).—South Temp. Atlantic: 311 (*4*).—30°–40° S.: 80 (*4**), 81 (*1**), 83 (*1**), 84 (*4*), 85 (*24*), 86 (*200*), 87 (*28*), 89 (*14*), 92 (*23*), 93 (*47*), 107 (*3*), 109 (*25*), 112 (*6*), 118 (*9*), 120 (*42*), 122 (*4*), 126 (*1*), 127 (*500*), 129 (*6*), 130 (*17*), 131 (*5*), 132 (*400*).—50°–60° S.: 235 (*1*), 236 (*12*), 238 (*9*), 240 (*1**), 241 (*4*).

13. *Calanus robustior* Giestr.

Calanus robustior Giesbrecht, 1892.

Occurrence.—Fairly common in the Atlantic between 30° N. and 18° S.

Remarks.—Length, ♀, 4·05–4·32 (North Temp. Atlantic).

Records.—North Temp. Atlantic: 18 (*8*), 66 (*7*), 67 (*23*), 68 (*160*), 69 (*1*).—Tropical Atlantic: 50 (*5*), 53 (*10*), 56 (*1*), 58 (*2*), 59 (*6*), 63 (*4*), 64 (*45*), 65 (*42*).

14. *Calanus tenuicornis* Dana.

Calanus tenuicornis Giesbrecht, 1892.

Occurrence.—Common off North Island, New Zealand. Two specimens were taken in the North Temp. Atlantic and one south of New Zealand.

Remarks.—Length, ♀, 1·8–2·1 mm. (off New Zealand).

Records.—North Temp. Atlantic: 66 (*1*), 70 (*1*).—30°–40° S.: 71 (*24*), 74 (*5*), 75 (*4*), 77 (*5*), 80 (*2*), 81 (*30*), 82 (*4*), 83 (*8*), 84 (*225*), 85 (*270*), 86 (*2760*), 87 (*78*), 89 (*2*), 92 (*2*), 93 (*8*), 97 (*20*), 99 (*2*), 100 (*1*), 107 (*70*), 112 (*155*), 114 (*190*), 118 (*272*), 120 (*18*),

122 (*1*), 127 (*250*), 128 (*480*), 132 (*400*), 136 (*2*), 143 (*1*), 146 (*62*), 148 [b (*1*), d (*1*), i (*5*)]. —**50°–60°** S. : 236 (*1*).

15. *Eucalanus elongatus* (Dana).

Eucalanus elongatus Giesbrecht, 1892.

Occurrence.—Common off New Zealand as far south as 52° 41′ S.

Records.—North Temp. Atlantic : 70 (*14*).—**30°–40°** S. : 72 (*3*), 75 (*2*), 76 (*1*), 80 (*1*), 81 (*3*), 83 (*1*), 85 (*45*), 92 (*9*), 93 (*44*), 100 (*1*), 103 (*2*), 106 (*3*), 107 (*16*), 109 (*156*), 111 (*5*), 112 (*5*), 113 (*28*), 114 (*20*), 118 (*4*), 120 (*61*), 122 (*22*), 126 (*5*), 127 (*11*), 129 (*16*), 130 (*23*), 131 (*25*), 132 (*40*), 133 (*37*), 135 (*3*), 136 (*7*), 137 (*1*), 139 (*21*), 140 (*8*), 143 (*2*).—**50°–60°** S. : 235 (*145*), 236 (*166*), 237 (*5*), 238 (*140*), 240 (*1*), 241 (*1*).

16. *Eucalanus attenuatus* Dana.

Occurrence.—Common off North Island, New Zealand. It also occurred on three stations on the western side of the South Atlantic.

Records.—Tropical Atlantic : 39 (*4*), 40 (*3*).—South Temp. Atlantic : 311 (*1*).—**30°–40°** S. : 85 (*135*), 86 (*12*), 92 (*1*), 93 (*9*), 100 (*1*), 107 (*8*), 109 (*6*), 110 (*1*), 111 (*1*), 112 (*7*), 113 (*33*), 114 (*26*), 118 (*2*), 120 (*73*), 122 (*13*), 126 (*10*), 127 (*250*), 129 (*11*), 130 (*40*), 131 (*95*), 132 (*15*), 133 (*50*), 135 (*12*), 136 (*1*), 137 (*25*), 139 (*5*), 141 (*2*), 143 (*3*).

17. *Eucalanus subtenuis* Giestr.

Eucalanus subtenuis Giesbrecht, 1892.

Occurrence.—One specimen in the Tropical Atlantic in 6° N.

Remarks.—Length, ♀, 3·4 mm.

Record.—Trop. Atlantic : 63 (*1*).

18. *Eucalanus mucronatus* Giestr.

Eucalanus mucronatus Giesbrecht, 1892.

Occurrence.—A few specimens on two stations between Three Kings Island and North Island, New Zealand.

Remarks.—Length, ♀, 3·1 mm.

Records.—**30°–40°** S. : 120 (*3*), 126 (*6*).

19. *Eucalanus acus*, n. sp. Fig. 3.

Description.—Female, length 4·3–4·8 mm. Cephalothorax (fig. 3 *a*) elongate slender six times as long as the abdomen, the cephalon uniformly tapered into an acute point in front of the antennules.

Abdomen (fig. 3 *b*) three jointed, the genital segment globose, about as wide as long, the second segment one-third as long as the genital segment and half as long as the anal, the anal segment partly fused with the short funa. Funal rami as wide as

long and half as long as the anal segment, each with a minute inner seta and two moderately stout terminal setæ, the innermost of the terminal setæ on the right ramus is slightly thicker than the rest. No other furcal setæ were observed, but they may have been broken off.

Antennules broken in all the specimens seen. Antennæ (fig. 3 *c*) with the exopodite reaching to the middle of the second joint of the endopodite, which is very short and has the second joint longer than the first as in *E. crassus*. Mandible (fig. 3 *d*) with very small endopodite bearing three terminal setæ and situated close to the distal end of the second basal joint. First maxilla (fig. 3 *e*) of the same type as in *E. attenuatus* with slender exopodite reaching to the middle of the second joint of the basipodite and bearing five setæ. Only two inner lobes were seen on the first basal joint, the first of the usual form with stout spines, the second small with four terminal setæ. Second maxilla, maxillipede and swimming feet without definite specific characters.

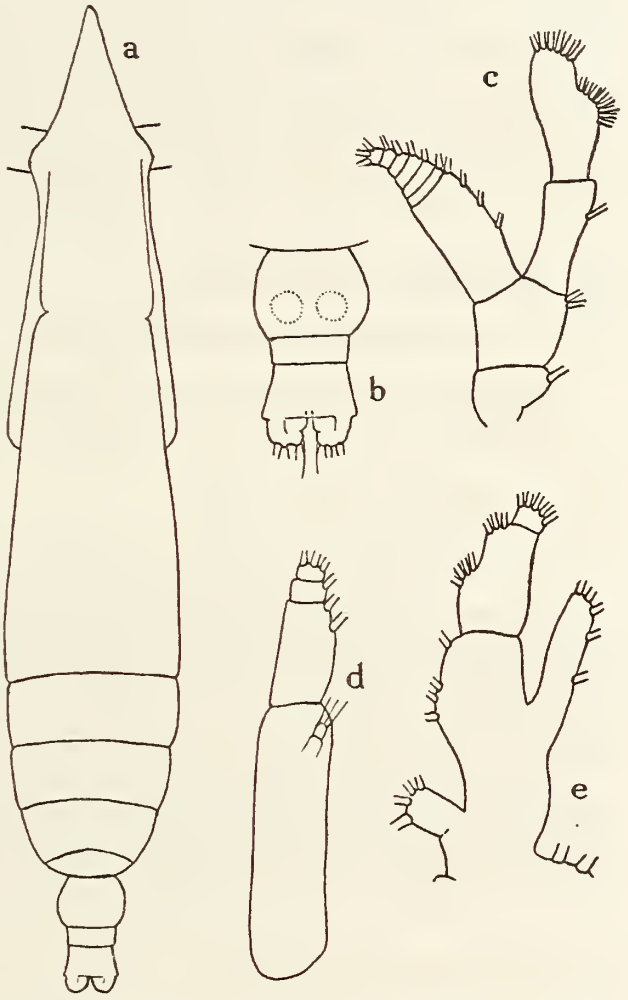

Fig. 3.—*Eucalanus acus*, n. sp. Female: *a*, dorsal view, × 29; *b*, abdomen, ventral view, × 50; *c*, antenna, × 71; *d*, mandible palp, × 71; *e*, first maxilla, distal portion, × 112.

Occurrence.—Females and immature specimens were taken in considerable numbers from the surface to 80 metres in a limited area south of New Zealand from 51° 22′ S. to 61° 18′ S. One female was taken in Melbourne Harbour.

Remarks.—All stages of this species are easily recognised by the elongated conical cephalon.

Records.—**30°–40°** S.: 161 (*1*).—**50°–60°** S.: 212 (*4**), 232 (*12**), 235 (*163*), 236 (*74*), 238 (*50*), 241 (*180*), 248 (*1**), 250 (*17,280*), 251 (*9850**), 252 (*940**), 256 (*145**), 259 (*110**), 302 (*46**).—**60°–66° 30′** S.: 300 (*7**).

20. *Eucalanus subcrassus*, Giesbr.

Eucalanus subcrassus, Giesbrecht, 1892.

Occurrence.—Abundant on two stations off Rio de Janeiro.

Remarks.—Length, ♀, 2·10–2·16 mm., ♂, 2·08–2·16 mm. This is rather smaller than the size given by Giesbrecht, viz.: ♀, 2·35–2·68 mm., ♂, 2·4 mm.

Records.—Tropical Atlantic: 39 (*1920*), 40 (*130*).

21. *Eucalanus crassus*, Giesbr.

Eucalanus crassus, Giesbrecht, 1892.

Occurrence.—Frequent in small numbers off New Zealand.

Remarks.—Length, ♀, 2·8–3·48 mm., ♂, 2·9–3·1. Integument smooth.

Records.—North Temp. Atlantic: 70 (*1**).—**30°–40°** S.: 86 (*1**), 87 (*1**), 92 (*1**), 93 (*8*), 109 (*5*), 111 (*1**), 112 (*1**), 114 (*40*), 118 (*1*), 120 (*8*), 126 (*5*), 130 (*2*), 131 (*9*), 132 (*10*), 133 (*19*), 135 (*6*), 136 (*1*), 139 (*2*).

22. *Rhincalanus cornutus* (Dana).

Rhincalanus cornutus, Giesbrecht, 1892.

Occurrence.—Found twice in the Tropical Atlantic and twice off New Zealand.

Records.—Trop. Atlantic: 43 (*1*), 59 (*1*).—**30°–40°** S.: 93 (*1*), 120 (*7*).

23. *Rhincalanus nasutus*, Giesbr.

Rhincalanus nasutus, Giesbrecht, 1892.

Occurrence.—On one station off the Azores. Common off the north-west point of New Zealand, where its most southerly station was in 34° 38′ S.

Remarks.—Length, ♀, 4·5–5·0 mm. In the following list of records the adults and immature specimens were not always separately entered.

Records.—North Temp. Atlantic: 70 (*23*).—**30°–40°** S.: 71 (*1*), 77 (*2*), 80 (*1*), 84 (*1*), 86 (*2*), 87 (*1*), 89 (*2*), 92 (*3*), 93 (*8*), 107 (*10*), 109 (*130*), 111 (*6*), 112 (*3*), 113 (*17*), 114 (*22*), 118 (*8*), 120 (*158*), 122 (*36*), 126 (*13*), 127 (*375*), 128 (*120*), 129 (*65*), 130 (*60*), 131 (*25*), 132 (*83*), 133 (*250*), 135 (*123*), 136 (*57*), 137 (*6*), 139 (*56*), 140 (*6*), 141 (*3*).

24. *Rhincalanus gigas*, Brady.

Rhincalanus grandis, Giesbrecht, 1902; *Rhincalanus grandis*, Wolfenden, 1911.

Occurrence.—From 54° 02′ S. southwards to the ice, frequent. Most numerous between 60° and 70° S. Taken also under the ice, but only on three occasions in very small numbers. There is a gap of 1200 sea-miles between the most northerly record of this species and the most southerly record of *R. nasutus*.

Remarks.—Length, ♀, 7·8–8·7 mm. There seems to me to be no doubt that Brady's figures and description of *R. gigas* in the Challenger Report were based mainly on the Antarctic species which Giesbrecht subsequently described as *R. grandis*, but that some of Brady's records of *R. gigas* refer to the species now known as *R. nasutus*.

It is true that there are some descrepancies in Brady's description which prevented

Giesbrecht from using the name *R. gigas*, but one of these, viz. the presence of two spines on the first abdominal segment, can be explained by the fact that these spines are well developed in stage V, and, as I have found, are sometimes present as small rudiments in the adult female.

The statement of Brady that there are spines on the postero-ventral angles of the last three thoracic segments is either a pure error or is due to confusion with *R. nasutus* which has such spines on the 2nd, 3rd, and 4th segments and also has dorso-lateral spines on the 3rd and 4th thoracic segments. The presence of these dorso-lateral spines in *R. nasutus*, which Brady expressly says are absent in *R. gigas*, forms, in addition to size and distribution, a distinctive character by which *R. nasutus* can be separated from *R. gigas* and speaks against the view held by T. Scott (1912) that the Antarctic species is only a large form of the more widely distributed *R. nasutus*.

Records.—**50°–60°** S. : 250 (*20*), 256 (*3**), 302 (*8**).—**60°–66° 30′** S. : 228 (*10*), 229 (*1*), 230 (*5*), 298 (*2*), 300 (*250*).—**66° 30′–76°** S. : 172 (*36*), 177 (*7*), 180 (*120*), 270 (*110*), 271 (*1**), 274 (*3*), 275 (*70*), 281 (*4**), 287 (*1*), 288 (*5*), 293 (*1*).—**76°–78°** S. : 317 [7 (*2**), 11 (*1*), 15 (*6**)], 342 (*1**).

25. *Mecynocera Clausi*, J. C. Thomps.

Mecynocera Clausi, Giesbrecht, 1892.

Occurrence.—This ubiquitous species was found over all the area traversed north of 42° 06′ S. and was especially plentiful off North Island, New Zealand.

Records.—North Temp. Atlantic : 8 (*1*), 11 (*2*).—Tropical Atlantic : 25 (*3*).—South Temp. Atlantic : 311 (*4*).—**30°–40°** S. : 71 (*84*), 72 (*33*), 73 (*78*), 74 (*8*), 75 (*12*), 76 (*250*), 77 (*18*), 78 (*1*), 79 (*1*), 82 (*30*), 83 (*250*), 84 (*90*), 85 (*90*), 86 (*280*), 87 (*12*), 92 (*1*), 93 (*4*), 94 (*4*), 97 (*8*), 98 (*1*), 99 (*3*), 100 (*30*), 101 (*43*), 103 (*4*), 104 (*2*), 105 (*2*), 106 (*7*), 108 (*5*), 110 (*1*), 112 (*4*), 113 (*1*), 114 (*2*), 116 (*2*), 118 (*1*), 119 (*10*), 120 (*420*), 126 (*1*), 128 (*1440*), 132 (*150*), 136 (*15*), 140 (*15*), 146 (*100*), 148 [e (*1*), f (*1*)].—**40°–50°** S. : 200 (*2*), 201 (*10*).

26. *Paracalanus parvus* (Cls.)

Paracalanus parvus, Sars, 1903.

Occurrence.—Over all the area traversed as far south as 43° 52′ S.

Remarks.—Length, ♀, 0·75–1·02 mm., ♂, 0·82–1·02 mm. There is a good deal of variation amongst the females, both in size and also in the shape of the cephalon which, off New Zealand, is usually more acute than in the North Atlantic form as figured by Sars (1903). No definite varietal distinction, however, could be recognised.

Records.—North Temp. Atlantic : 3 (*2*), 4 (*135*), 6 (*2*), 14 (*1*), 70 (*17*).—Trop. Atlantic : 39 (*3*), 40 (*425*), 43 (*2*).—South Temp. Atlantic : 311 (*4*).—**30°–40°** S. : 71 (*120*), 72 (*5*), 73 (*156*), 74 (*2*), 75 (*7*), 76 (*410*), 77 (*70*), 78 (*12*), 83 (*2*), 84 (*2*), 94 (*53*), 97 (*4*), 98 (*5*), 99 (*22*), 100 (*3*), 101 (*3*), 114 (*10*), 116 (*5*), 117 (*24*), 118 (*5*), 119 (*500*),

120 (*1*), 128 (*48*), 137 (*90*), 138 (*3*), 140 (*2*), 146 (*100*), 147 (*13*), 148 [a (*480*), b (*326*), c (*60*), d (*830*), e (*17*), f (*1380*), g (*105*), h (*215*), i (*183*), j (*310*)], 202 (*1*).—**40°–50°** S.: 201 (*76*), 204 (*8*).

27. *Paracalanus aculeatus*, Giesbr.

Paracalanus aculeatus, Giesbrecht, 1892.

Occurrence.—Frequent in the Tropical Atlantic and very abundant on some stations. Once off New Zealand.

Remarks.—Length, ♀, 1·08–1·14 mm.

Records.—Tropical Altantic: 39 (*6180*), 40 (*1125*), 43 (*7*), 50 (*54*), 52 (*1760*), 53 (*1260*), 56 (*20*), 51 (*8*), 58 (*31*), 61 (*230*), 62 (*50*), 63 (*100*).—**30°–40°** S.: 89 (*2*).

28. *Acrocalanus longicornis*, Giedr.

Acrocalanus longicornis, Giedrecht, 1892.

Occurrence.—Plentiful in the Tropical Atlantic, usually in company with *Paracalanus aculeatus*, but it is worth noting that it was absent from Stations 39 and 40, off Rio de Janeiro, on which *P. aculeatus* was abundant.

Remarks.—Length, ♀, 1·13–1·18 mm.

Records.—North Temp. Atlantic: 68 (*12*).—Trop. Atlantic: 43 (*690*), 50 (*540*), 52 (*2420*), 53 (*420*), 56 (*20*), 57 (*2340*), 58 (*16*), 59 (*50*), 61 (*60*), 62 (*130*), 63 (*390*).—South Temp. Atlantic: 311 (*1*).

29. *Calocalanus pavo* (Dana).

Calocalanus pavo, Giesbrecht, 1892.

Occurrence.—Widespread throughout the area traversed as far south as 40° 12′ S., but not usually in large numbers.

Records.—North Temp. Atlantic: 11 (*1**), 66 (*5*).—Trop. Atlantic: 25 (*5*), 40 (*1*), 43 (*120*), 50 (*198*), 52 (*68*), 53 (*110*), 56 (*3*), 57 (*6*), 58 (*6*), 59 (*50*), 62 (*480*), 63 (*380*), 64 (*38*), 65 (*90*).—South Temp. Atlantic: 311 (*1*).—**30°–40°** S.: 72 (*2*), 75 (*3*), 76 (*1*), 78 (*1*), 81 (*4*), 82 (*1*), 83 (*5*), 84 (*4*), 85 (*135*), 87 (*1*), 103 (*1*), 105 (*1*), 107 (*88*), 108 (*5*), 112 (*3*), 114 (*3*), 120 (*140*), 127 (*250*), 128 (*240*), 132 (*10*), 140 (*1*), 146 (*12*).—**40°–50°** S.: 201 (*1**).

30. *Calocalanus styliremis*, Giesbr.

Calocalanus styliremis, Giesbrecht, 1892.

Occurrence.—On two stations in the North Atlantic. Common off New Zealand.

Remarks.—Length, ♀, 0·65–0·74 mm. The form of the body in the New Zealand specimens is much more slender in dorsal view than in Giesbrecht's figure, the greatest

width being about one-third of the length of the cephalothorax, thus approaching *Calocalanus contractus* (Farran, 1926) in form, but as the fifth feet had only one terminal seta, I have recorded them as *C. styliremis*. Two females from Stations 73 and 74, lengths 0·92 and 0·95 mm., of the same slender form, had on the end of each fifth foot a minute outer tooth, two terminal setæ, of which the outer was as long as the third joint and the inner twice as long, and three minute spinules. The third joint had a rudimentary segmentation. These specimens are hardly to be distinguished from *C. contractus*.

Records.—North Temp. Atlantic: 66 (*2*), 70 (*2*).—**30°–40°** S.: 71 (*216*), 72 (*1*), 73 (*109*), 74 (*50*), 75 (*1*), 76 (*285*), 77 (*70*), 78 (*3*), 82 (*71*), 83 (*1*), 84 (*2*), 86 (*1*), 87 (*1*), 99 (*3*), 100 (*2*), 104 (*3*), 105 (*23*), 107 (*10*), 116 (*2*), 117 (*1*), 119 (*10*), 128 (*1920*). —**40°–50°** S.: 201 (*50*).

31. *Calocalanus plumulosus* (Cls.).

Calocalanus plumulosus, Giesbrecht, 1892.

Occurrence.—Taken once in the North Atlantic. Plentiful off North Island, New Zealand.

Remarks.—Length, ♀, 1·17–1·30 mm.

Records.—North Temp. Atlantic: 11 (*1**).—**30°–40°** S: 71 (*30*), 72 (*8*), 73 (*2*), 75 (*4*), 76 (*20*), 77 (*4*), 79 (*1*), 83 (*1*), 84 (*210*), 85 (*225*), 86 (*240*), 87 (*222*), 97 (*9*), 98 (*1*), 99 (*1*), 100 (*1*), 105 (*2*), 106 (*24*), 107 (*88*), 108 (*5*), 112 (*6*), 114 (*80*), 119 (*22*), 120 (*840*), 127 (*125*), 128 (*480*), 132 (*30*), 133 (*3*), 140 (*6*), 148 [j (*1*)].

32. *Clausocalanus arcuicornis* (Dana).

Clausocalanus arcuicornis, Giesbrecht, 1892.

Occurrence.—Abundant over the whole region traversed, north of the Antarctic Circle.

Remarks.—I have not attempted to find specific characters to separate the various size groups which occur in this species, merely noting the sizes of the females occurring in different areas; *Clausocalanus pergens* has, however, been retained as a distinct species.

In the North Temperate Atlantic the prevailing size of female was 1·38–1·44 mm. with occasional specimens of 1·5–1·55 mm. and a few as small as 1·32 mm. In the Tropical Atlantic the usual size was 1·45–1·6 mm. with a few at 1·1–1·2 on three stations. On the two South Temperate Atlantic stations the sizes were 1·38–1·55 mm. Off New Zealand the sizes varied from 1·2 to 1·6 mm., a few reading 1·8 mm. on stations 106 and 128. On many stations the commonest size was 1·2–1·3 mm. with a small number of the larger sizes, but at times the larger sizes, 1·4–1·55 mm., predominated. Some variation was also noted in the form of the rostrum which was sometimes straight, especially in the larger specimens and sometimes curved downwards. In the Bay

of Islands the size was 1·35–1·44 mm. with curved rostrum. From 50°–60° S. the size was 1·32–1·74 mm., and the single female taken south of the Antarctic Circle measured 1·68 mm.

Records.—North Temp. Atlantic : 4 (*2*), 8 (*4*), 9 (*5*), 10 (*8*), 11 (*12*), 18 (*22*), 66 (*130*), 67 (*27*), 68 (*48*), 70 (*2*).—Trop. Atlantic : 23 (*7*), 25 (*1*), 43 (*1*), 50 (*54*), 52 (*4*), 58 (*14*), 59 (*20*), 63 (*1*), 64 (*114*), 65 (*80*).—South Temp. Atlantic : 310 (*245*), 311 (*4*).—**30°–40°** S. : 71 (*160*), 72 (*110*), 73 (*50*), 74 (*30*), 75 (*150*), 76 (*80*), 77 (*180*), 78 (*4*), 79 (*36*), 80 (*3*), 81 (*150*), 82 (*125*), 83 (*2500*), 84 (*2220*), 85 (*190*), 86 (*430*), 87 (*340*), 89 (*8*), 92 (*8*), 94 (*30*), 97 (*147*), 99 (*2**), 100 (*75*), 101 (*1100*), 103 (*14*), 104 (*4*), 105 (*2*), 106 (*12,880*), 107 (*3580*), 108 (*800*), 109 (*15*), 112 (*645*), 113 (*9*), 114 (*1070*), 116 (*5*), 117 (*18*), 118 (*5980*), 119 (*186*), 120 (*26,000*), 122 (*4*), 127 (*147,000*), 128 (*4800*), 132 (*1000*), 135 (*1*), 137 (*265*), 138 (*24*), 140 (*800*), 146 (*440*), 147 (*147*), 148 [a (*80*), b (*110*), c (*2*), d (*22*), f (*20*), h (*40*), i (*4*), j (*48*)].—**40°–50°** S. : 200 (*40*), 201 (35), 204 (*3*), 208 (*2*), 303 (*8*).—**50°–60°** S. : 199 (*1*), 235 (*2*), 240 (*5*), 241 (*8*), 250 (*1220*), 251 (*40*), 252 (*40*), 256 (*210*), 259 (*1800*), 305 (*950*).—**66° 30′–76°** S. : 275 (*1*).

33. *Clausocalanus pergens*, Farran.

Clausocalanus pergens, Farran, 1926.

Occurrence.—Common in the North Temperate Atlantic and off New Zealand.

Remarks.—Length, ♀, 0·9–1·0 mm. These specimens appeared to be the same as those described from the Bay of Biscay.

Records.—North Temp. Atlantic : 4 (*1*), 10 (*300*), 70 (*17*).—**30°–40°** S. : 75 (*15*), 76 (*45*), 77 (*25*), 86 (*1*), 97 (*189*), 105 (*1*), 108 (*1*), 110 (*1*), 116 (*1*), 118 (*408*), 119 (*19*), 120 (*70*), 128 (*1920*), 132 (*50*), 140 (*28*), 141 [j (*1*)].—**40°–50°** S. : 201 (*18*).

34. *Clausocalanus paululus*, Farran.

Clausocalanus paululus, Farran, 1926.

Occurrence.—Moderately common off New Zealand.

Remarks.—Length 0·72–0·75 mm. Apparently identical with *C. paululus* from the N.E. Atlantic.

Records.—**30°–40°** S. : 71 (*12*), 74 (*20*), 76 (*147*), 77 (*20*), 78 (*13*), 82 (*45*), 84 (*3*), 85 (*2*), 87 (*1*), 105 (*3*), 117 (*3*), 119 (*12*), 128 (*960*), 202 (*1*).—**40°–50°** S. : 201 (*1*).

35. *Clausocalanus laticeps*, n. sp. Fig. 4.

Description.—Female, length 1·32–1·65 mm., average length about 1·45 mm. General form of the body as in *Clausocalanus arcuicornis*, but the cephalon, which in dorsal view is uniformly oval, in lateral view is anteriorly much broader and more flattened (fig. 4 *a*). Rostrum moderately slender and bent downwards towards the antennules by whose basal joints the tip is concealed.

Abdomen (fig. 4 *b*), one-third the length of the cephalothorax, the abdominal

segments and furca being in lateral view in the proportion 13, 7, 6, 4, 5. Genital segment not swollen ventrally, furcal rami one and a half times as long as broad, slightly divergent.

Appendages resembling those of *C. arcuicornis*, but the swimming feet, while agreeing in structure and spinulation, are slightly more slender, especially the third pair (fig. 4 *c*). Fifth feet (fig. 4 *d*) symmetrical, of three joints sub-equal in length, first and second joints moderately stout, third joint more slender and deeply notched at the tip. The antennules reach to the end of the cephalothorax.

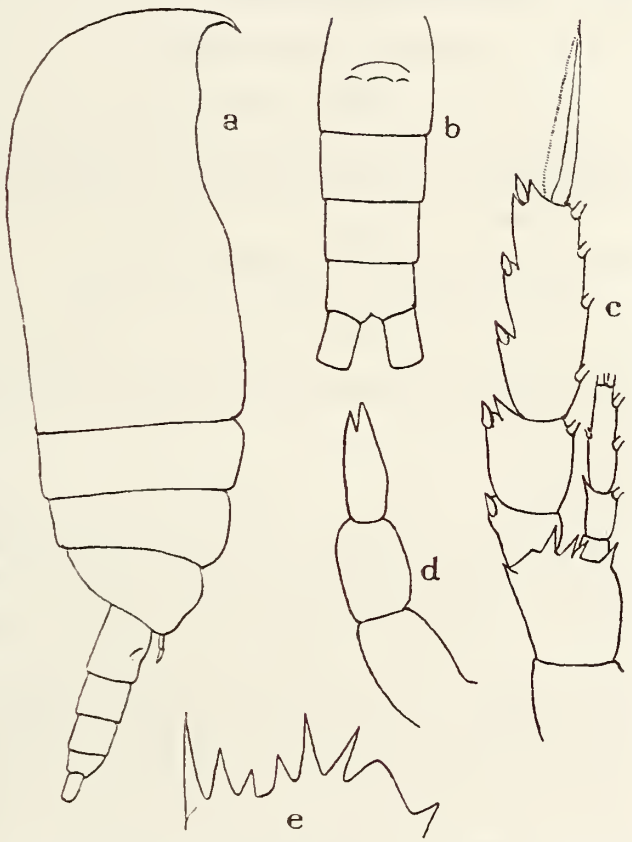

Fig. 4.—*Clausocalanus laticeps*, n. sp. Female : *a*, lateral view, × 69 ; *b*, abdomen, ventral view, × 120 ; *c*, third foot, × 158 ; *d*, fifth foot, × 468 ; *e*, distal margin of second joint of basipodite of second foot, × 330.

Occurrence.—In moderate numbers at or near the surface to the south of New Zealand between 51° 47′ S. and 64° 03′ S.

Remarks.—This species is easily distinguished from the various forms of *Clausocalanus arcuicornis* by the very flattened cephalon. Its outline in lateral view is not unlike that of *Scolecithricella minor*, and it is not impossible that the two species may have been confused by Brady (1883) in his Challenger Report. This would account for the fact that he figures as the fifth feet of *S. minor* a pair of appendages which obviously belong to a species of *Clausocalanus*. Brady's specimens of *S. minor* were taken in 46° 46′ S. to the south-east of South Africa in the West Wind Drift, where the present species might be expected to occur.

Records.—**50°–60°** S. : 197 (*1*), 232 (*1*), 235 (*8*), 236 (*3*), 240 (*1*), 250 (*60*), 251 (*18*), 252 (*10*), 256 (*4*), 259 (*20*), 305 (*280*).—**60°–66° 30′** S. : 228 (*5*), 230 (*12*).

36. *Clausocalanus furcatus* (Brady).

Clausocalanus furcatus, Giesbrecht, 1892.

Occurrence.—Only found in the Atlantic townettings ; most abundant in the Tropical Atlantic.

Records.—North Temp. Atlantic : 8 (*16*), 9 (*1*), 11 (*23*), 18 (*75*), 66 (*170*), 67 (*110*),

68 (*168*).—Trop. Atlantic: 23 (*263*), 26 (*3*), 29 (*350*), 39 (*4600*), 40 (*14,200*), 43 (*270*), 50 (*288*), 52 (*15*), 53 (*90*), 56 (*20*), 57 (*10*), 58 (*53*), 59 (*320*), 61 (*180*), 62 (*460*), 63 (*840*), 64 (*320*), 65 (*210*).—South Temp. Atlantic: 310 (*154*), 311 (*5*).

37. *Ctenocalanus vanus*, Giesbr.

Ctenocalanus vanus, Giesbrecht, 1892.

Occurrence.—Taken in abundance off Rio de Janeiro, and continuously in large numbers from off the north of New Zealand to the most southerly point reached. One of the most plentiful species in the townettings taken under the ice.

Remarks.—Length, ♀, Tropical Atlantic, 1·2–1·25 mm., off New Zealand, 1·02–1·2 mm., Antarctic, 1·08–1·44 mm.

Records.—Trop. Atlantic: 39 (*1680*), 40 (*4350*).—**30°–40°** S.: 71 (*12*), 73 (*1*), 74 (*1*), 75 (*11*), 76 (*45*), 78 (*1*), 81 (*8*), 82 (*40*), 83 (*527*), 84 (*855*), 85 (*1170*), 86 (*3560*), 87 (*445*), 89 (*2*), 92 (*1*), 94 (*22*), 97 (*74*), 99 (*2*), 100 (*1*), 101 (*96*), 103 (*3*), 105 (*1*), 106 (*455*), 107 (*1360*), 109 (*1*), 110 (*1*), 112 (*225*), 114 (*100*), 120 (*1470*), 127 (*850*), 128 (*960*), 132 (*400*), 137 (*20*), 140 (*28*), 147 (*1*), 148 [a (*67*), b (*2*), c (*1*), e (*2*), f (*10*), h (*8*), i (*5*), j (*7*)].—**40°–50°** S.: 201 (*4*).—**50°–60°** S.: 197 (*140*), 223 (*3*), 250 (*1*), 305 (*240*).—**60°–66° 30′** S.: 167 (*360*), 215 (*20*), 228 (*590*), 229 (*1*), 230 (*510*), 264 (*90*).—**60° 30′–76°** S. 221 (*4*), 224 (*4*), 226 (*1*), 227 (*1*), 231 (*1*).—**76°–78°** S.: 222 (*26*), 223 (*13*), 317 [4 (*1200*), 5 (*454*), 6 (*2900*), 7 (*6960*), 9 (*682*), 10 (450), 11 (*38*), 15 (*60*), 17 (*198*), 18 (*1062*), 19 (*32*), 21 (*1200*), 22 (*360*), 23 (*120*), 24 (*1050*), 29 (*3175*), 30 (*2180*), 31 (*1070*), 37 (*960*), 38 (*2700*)], 323 [39 (*30*), 41 (*4*), 43 (*4*), 44 (*20*), 45 (*1*)], 325 (*88*), 336 (*20*), 342 (*10*), 343 (*1*), 345 (*108*), 346 (*8*), 347 (*90*), 351 [57 (*1580*), 58 (*10,230*), 59 (*2960*), 60 (*8900*), 61 (*200*), 62 (*165*), 63 (*140*), 64 (*30*), 65 (*160*)], 352 (*4650*).

38. *Microcalanus pygmæus*, G. O. Sars.

Microcalanus pygmæus, Giesbrecht, 1902.

Occurrence.—A few specimens were taken through holes in the ice off Cape Evans.

Remarks.—Length, ♀, 0·7–0·88 mm., ♂, 0·8 mm. The females agreed closely with Giesbrecht's description of the "Belgica" specimens. The swimming feet are much more slender and the terminal spines of the exopodites longer and more finely toothed than in *Mirocalanus pusillus*, as figured by Sars (1903), to which species Wolfenden (1908, 1911) has referred his Antarctic specimens. The specific distinctions between the two species are, however, not very clear.

Records.—**76°–78°** S.: 317 [15 (*1*), 18 (*1*), 22 (*30*), 29 (*2*), 30 (*5*)], 352 (*2*).

39. *Stephus longipes*, Giesbr.

Stephus longipes, Giesbrecht, 1902.

Occurrence.—This typical Antarctic form was only found south of 76° S. where it occurred frequently, usually under the ice. Giesbrecht found it in the "Belgica" collec-

tions between 69° 55′ S. and 71° 02′ S. and Wolfenden in the "Gauss" collections from 66° S. and also in the "Discovery" collections.

Remarks.—Length, ♀ 0·72–0·96 mm., ♂, 0·78–0·9 mm.

Records.—**76°–78°** S.: 222 (*1*), 317 [9 (*1*), 15 (*1*), 17 (*2*), 18 (*28*), 23 (*10*), 29 (*70*), 30 (*55*), 31 (*20*), 37 (*20*), 38 (*20*)], 323 [48 (*1*)], 325 (*1*), 351 [59 (*32*), 60 (*70*)].

40. *Spinocalanus abyssalis*, Giesbr.

Spinocalanus abyssalis, Giesbrecht, 1892.

Occurrence.—Several specimens were taken in Antarctic waters in vertical hauls from 400 metres or deeper.

Remarks.—Length, ♀, 1·8–2·06 mm. with the exception of two specimens from Stn. 172, 400–0 m., which measured only 1·18 and 1·20 mm., thus approaching the var. *pygmæus* (Farran, 1926).

Records.—**66° 30′–76°** S.: 172 (*3*), 177 (*2*), 270 (*7*), 276 (*2*), 282 (*5*), 285 (*3*).

41. *Spinocalanus magnus*, Wolfenden.

Spinocalanus magnus, G. O. Sars, 1925.

Occurrence.—All specimens were from within the Antarctic Circle and came from vertical hauls which reached 400 metres or deeper, with the exception of one immature specimen from Stn. 288, 0–60 m.

Remarks.—Length, ♀, 2·4–2·76 mm. Wolfenden (1911) has recorded both *S. magnus* and *S. abyssalis* from the Antarctic collections of the "Gauss," and also a new species *S. antarcticum*, very closely resembling *S. magnus*, but separated by its stouter form, less produced fifth thoracic segments and shorter first antenna, and also by having the inner ramus of the second antenna only three-quarters the length of the outer ramus instead of about five-sixths as in *S. magnus*. It may be noted that Sars (1925) figures the second antenna of *S. magnus* with the inner ramus four-fifths the length of the outer.

Records.—**60° 30′–76°** S.: 178 (*1*), 270 (*9*), 276 (*1**), 282 (*52*), 275 (*3*), 288 (*1**).

42. *Spinocalanus spinosus*, Farran.

Spinocalanus spinosus, Farran, 1908.

Occurrence.—Two specimens, females, were found in a vertical haul from 1000 metres in the Antarctic.

Remarks.—Length, ♀, 2·3 and 2·45 mm. There appears to be no difference except size between these specimens and those from the West Coast of Ireland, the latter measuring 1·85–2·0 mm. The cephalothorax in the Antarctic specimens is 2·6 times as long as the abdomen. In the specimens from the Irish coast it is 2·6–2·8 times as long. The second maxillipede in both is of the same elongated form as in *S. abyssalis*

with a transverse row of fine acicular spinules on the second joint. It seems probable that *S. horridus* of Wolfenden (1911), from deep water in the Tropical Atlantic, may prove to be the same species.

Record.—66° 30′–76° S.: 282 (*2*).

43. *Ætideus armatus* (Boeck).

Ætideus armatus, G. O. Sars, 1903.

Occurrence.—Two females were taken off North Island, New Zealand, and one in 52° S.

Remarks.—Length, ♀, 1·68–1·84 mm.

Records.—30°–40° S.: 74 (*1*), 85 (*1*).—50°–60° S.: 236 (*1*).

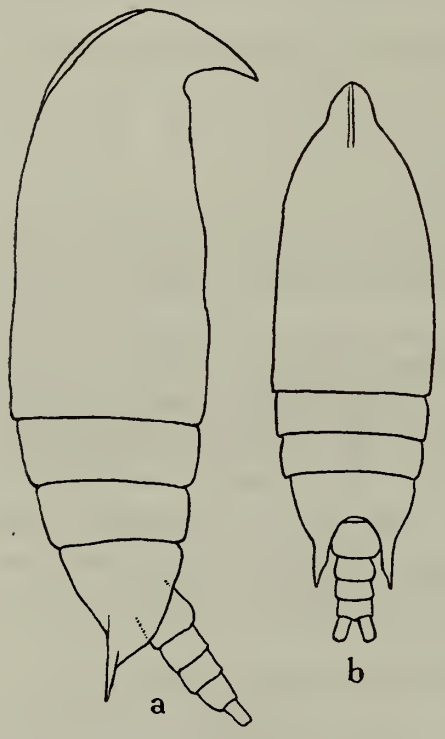

Fig. 5.—*Ætideus acutus*, n. sp. Female: *a*, lateral view, × 58; *b*, dorsal view, × 43.

44. *Ætideus Giesbrechti*, Cleve.

Ætideus Giesbrechti, G. O. Sars, 1925, A. Scott, 1909.

Occurrence.—On a few stations off New Zealand, surface to 100 metres.

Remarks.—Length, ♀, 1·92–1·98 mm.

Records.—30°–40° S.: 85 (*1*), 87 (*4*), 100 (*2*), 128 (*1*).

45. *Ætideus acutus*, n. sp. Fig. 5.

Description.—Female, length 1·68–1·8 mm. Cephalothorax in dorsal view (fig. 5 *b*) produced in front to a moderately sharp point with a marked construction on each side, just in front of the level of the antennules. The cephalon in lateral view (fig. 5 *a*) is strongly arched, with a well-marked chitinous crest. Rostrum very large and strongly chitinised with points slightly divergent and with a nodular process at the base of each point on the inner side as in *A. Giesbrechti*. Last thoracic segment produced into strong points reaching back almost to the hinder margin of the third anal segment. Each point in lateral view has a broad base with a dorsal chitinised thickening and a ventral wing-like expansion.

Abdomen contained about $3\frac{1}{4}$ times in the length of the cephalothorax in the mediodorsal line. Abdominal segments and furca in the proportion 14, 7, 6, 8, 8. Second abdominal segment constricted anteriorly. Antennules reaching to beyond the end of the furca. Thoracic appendages and swimming feet without distinctive specific characters, similar to those found in *A. Giesbrechti*.

Occurrence.—Only three specimens, females, were taken on three stations to the north-west of the north point of New Zealand, surface to 2 metres.

Remarks.—In most points this species comes very near to *A. Giesbrechti*, but the lateral constriction at the base of the rostrum, similar to that found in *A. Bradyi* from the Dutch East Indies (A. Scott, 1909) forms a ready method of distinguishing it. The expansions of the spinous projections of the last thoracic segment are also of a different form. This adds a fourth species to the three already known, as reviewed by A. Scott (1909).

Records.—30°–40° S.: 75 (*1*), 85 (*1*), 120 (*1*).

46. *Chiridius Poppei*, Giesbr.

Chiridius Poppei, Giesbrecht, 1892; *Chiridius Poppei*, G. O. Sars, 1925.

Occurrence.—Sixteen females and thirteen immature specimens were taken in a surface haul off New Zealand.

Remarks.—Length, ♀, 1·92–2·0 mm. Form of cephalothorax rather stout, thoracic spines not divergent, directed straight backwards, the distance between their tips being five-ninths the greatest width of the cephalothorax in dorsal view. Terminal spines of exopodites of 2nd to 4th swimming feet with about twenty-two teeth.

These specimens agree fairly closely with the descriptions of Giesbrecht and Sars.

Record.—30°–40° S.: 100 (*29*).

47. *Chiridius ? gracilis*, Farran. Fig. 6.

Chiridius gracilis, Farran, 1908; *Chiridius gracilis*, With, 1915.

Occurrence.—Three specimens were taken, along with *C. Poppei*, in a surface haul off New Zealand.

Remarks.—Length, ♀, 2·3–2·4 mm. These specimens approach very nearly to *C. gracilis* but differ in some small points. The thoracic spines are slightly divergent and in lateral view (fig. 6) show a slight basal thickening on the ventral edge. The outer edge lamina of the third joints of the exopodites of the 2nd and 3rd feet is of a slightly different form. The terminal spines of the exopodites of the 2nd to 4th feet have about twenty-four teeth. The position of the glandular pores could not be made out. Further, these specimens were taken in a surface haul while *C. gracilis* appears to be a deep water form in the North Atlantic.

Fig. 6. — *Chiridius gracilis*. Female, lateral angle of fifth thoracic segment.

Record.—30°–40° S.: *100* (3).

48. *Chiridius polaris*, Wolfenden.

Chiridius polaris, Wolfenden, 1911.

Occurrence.—One female in a vertical haul from 600 metres in 69° 51′ S.

Remarks.—Length, ♀, 4·14 mm., cephalothorax 3·12 mm., abdomen and furca 1·02 mm. Though this specimen is considerably larger than that described by Wolfenden, which measured 2·75 mm., I have recorded it under the same name, as the agreement in other respects is very close and both sizes are within the limits of possible variation. In the "Terra Nova" specimen the last segment of the thorax is rather contracted, the distance between the tips of the thoracic spines in dorsal view being one-half the total width and almost one-fifth the total length, in the middle line, of the cephalothorax. The thoracic spines are not convergent but are directed straight backwards. The abdominal segments are as figured by Wolfenden, with the furcal rami not quite twice as wide as long.

The endopodite of the 2nd foot is one jointed with imperfect segmentation. Both rami of the 3rd and 4th feet are completely three-jointed and are exceptionally narrow with the outer edge laminæ of the exopodites feebly developed. The terminal spines of the exopodites of the 3rd and 4th feet have about forty-four teeth.

This species seems to be the counterpart of the northern *Chiridius obtusifrons*, but differs chiefly in its more slender form.

Record.—**70° 30′–76°** S.: 270 (*1*).

49. *Chiridius antarcticus* (Wolfenden).

Faroella antarctica, Wolfenden, 1908.

Occurrence.—Taken on a few occasions in townettings taken through a hole in the ice at Winter Quarters.

Remarks.—Length, ♀, 4·41–4·80 mm. It was first described by Wolfenden (1908) from specimens taken by the "Discovery," fishing through a hole in the ice. These specimens measured 4·3 mm. He also records one specimen, length 3·55 mm., from the "Gauss" collections (1911).

The large size, the long slender rostrum with a slight downward curve and the closely papillate integument are easily recognised features of this species. The glandular pores of the swimming feet agree in position with those described for *Chiridius modestus* by With (1915), the openings being on the outer edge of the exopodites of the 2nd to 4th feet, one on each joint.

The terminal spines of the exopodites of the 2nd to 4th feet have about fifty teeth, each tooth being clearly separate down to its base.

The genus *Chiridius* is here used in its widest sense to comprise both rostrate and arostrate species, including thus both *Ætideopsis* and *Faroella*.

Records.—**76°–78°** S.: 317 [22 (*1**)], 351 [61 (*1*), 64 (*5*), 65 (*13*)].

50. *Chiridius minor*, Wolfenden.

Chiridius minor, Wolfenden.

Occurrence.—On four stations in the Antarctic in vertical hauls from 500, 600 and 1000 metres.

Remarks.—Length, ♀, 2·92–3·25 mm. Though these specimens differ from those described by Wolfenden in some points the general agreement is close and it seems best to record them under his name. The following are the principal points in which specimens differ; size rather larger, about 3 mm. instead of 2·56 mm., length of abdomen contained 3 times or more in that of cephalothorax instead of $2\frac{1}{2}$ times. Furcal rami $1\frac{1}{2}$ times as long as wide instead of twice. Rostrum, though not as large as in *C. antarcticus*, cannot be described as small, it is very similar to that of *Chiridius multiserratus*. Integument finely granulated; this is not mentioned by Wolfenden. Exopodite of 2nd antenna considerably longer than endopodite, the proportion being about 4 : 3, instead of only slightly longer.

The significant points of agreement are the forked rostrum with points not diverging, the well-marked separation between the 4th and 5th thoracic segments, the strong thoracic spines with broad bases, and the jointing of the swimming feet; the partial fusion of the basal joints of the 4th feet was not found, it may have been an abnormality. The terminal spines of the exopodites of the 2nd to 4th feet had fifty teeth partly fused at their bases by a sort of lamina. The glandular pores of the swimming feet appear to be the same as in *Chiridius modestus* (With, 1915).

Wolfenden's specimens were taken by the "Gauss" between 64° and 65° S., probably in deep-water hauls. The depth is not mentioned, but on the dates of capture hauls from 3000 and 1200 metres were made.

Records.—**66° 30′–76°** S.: 178 (*5*), 276 (*1*), 282 (*8*), 285 (*4*).

51. *Gaidius tenuispinus* (Sars).

Chiridius tenuispinus, Sars, 1903.

Occurrence.—In vertical hauls from depths of from 500 to 1750 metres in the Antarctic, frequent.

Remarks.—Length, ♀, 3·35–3·6 mm., ♂, 3·25 mm. The agreement with *G. tenuispinus* from the North Atlantic is very close. The terminal spines of the exopodites of the 2nd and 3rd feet had sixteen teeth and of the 4th feet nineteen teeth. With gives the number of teeth in his North Atlantic specimens as twenty-six, but I have found eighteen teeth on the 2nd and 3rd feet of a specimen from the west coast of Ireland. The thoracic spines of the males are more widely separated than in Sars' figure, the distance between them being six-tenths of the width of the cephalothorax instead of about half.

Records.—**66° 30′–76°** S.: 177 (*4*), 178 (*5*), 276 (*17*), 282 (*125*), 285 (*31*).

52. *Gaidius intermedius*, Wolfenden.

Gaidius intermedius, Wolfenden, 1908, 1911.

Occurrence.—In two deep vertical hauls from 1000 and 1760 metres in the Antarctic.

Remarks.—Length, ♀, 4·32–4·6 mm., V, 3·32–3·38 mm. Wolfenden figures but

does not mention the moderately long and markedly depressed rostrum, which is a noticeable feature in this species and serves to distinguish it from the allied *G. affinis* in which (Sars, 1925) the rostrum is short and stout and projects straight outwards.

Records.—66° 30′–76° S.: 276 (*3*), 282 (*6*).

53. *Drepanopsis frigidus*, Wolfenden.

Drepanopsis frigidus, Wolfenden, 1911.

Occurrence.—A few specimens in three vertical hauls in the Antarctic, 600–0, 1000–0, and 1750–0 metres.

Remarks.—Length, ♀, 2·58–2·88 mm. These specimens are slightly larger than those recorded by Wolfenden from the deep water of the Antarctic and the Atlantic, and the lateral prolongations of the 5th thoracic segments are not so acute as in his figure but in other respects the agreement is close. Sars (1920, 1925) has described and figured from a single specimen, under the name of *Farrania oblonga*, a species which is certainly congeneric and very probably identical with *Drepanopsis frigidus*. It is rather larger, 3·65 mm., the 5th thoracic segments are more rounded laterally and the antennules, as figured, are not so setose, the setæ, though corresponding in position, being apparently shorter and more slender. Possibly, the figure may be to some extent a restoration.

Only one of the "Terra Nova" specimens was mounted and in it the first outer edge spine of the third joint of the exopodite of the 2nd foot is absent, not broken off, on both sides, but the corresponding notch on the margin is present.

Wolfenden has compared his genus, possibly correctly, with *Drepanopus*, but Sars considered *Farrania* to be allied to *Spinocalanus*. The presence of five inner edge setæ on the third joints of the exopodites of 2nd–3rd feet in *Spinocalanus* and only four in *Farrania* seems incompatible with the latter relationship. The exact systematic position must remain uncertain till the male has been found.

Records.—66° 30′–76° S.: 276 (*2*), 282 (*2*), 285 (*1*).

54. *Pseudochirella notacantha* (G. O. Sars).

Pseudochirella notacantha, G. O. Sars, 1924.

Occurrence.—Two immature specimens in two vertical hauls from 1000 and 1760 metres in the Antarctic.

Remarks.—Both specimens, a male and a female, were in stage V and agreed in the form of the rostrum and thoracic spines with Sars' figures. They measured 4·45 and 4·5 mm.

Records.—66° 30′–76° S.: 276 (*1**), 282 (*1**).

55. *Gætanus minor*, Farran.

Gætanus minor, Farran, 1905.

Occurrence.—Several specimens were taken in two surface hauls, one by day and one by night, off New Zealand.

Remarks.—Length, ♀, 2·16 mm. Not previously recorded from the surface but taken at 50 fathoms by night by the "Research" in the Bay of Biscay (Farran, 1926).

Records.—**30°–40°** S.: 93 (*5*), 100 (*16*).

56. *Gætanus antarcticus*, Wolfenden.

Gætanus antarcticus, Wolfenden, 1905.

Occurrence.—Two specimens, both immature, stages V and III, in a vertical haul from 1000 metres in 71° 41′ S.

Remarks.—Length, V♂, 6·1 mm. The older specimen agreed fairly closely with Wolfenden's figure and description. The first antenna reached to the anal segment and the exopodite of the first foot was three-jointed with three outer edge spines. The cephalic spine was slightly longer and had a more pronounced ventral curve than in Wolfenden's figure and the thoracic spines, while corresponding in size and position, did not show the slight upward curve figured by Wolfenden but were directed straight backwards. Wolfenden records a single specimen, a female of 8 mm., from the "Gauss" collection in 66° S. (1911), and another from the "Discovery" collection (1908).

Record.—**60° 30′–76°** S.: 282 (*2**).

57. *Undeuchæta minor*, Giesbr.

Undeuchæta plumosa, G. O. Sars, 1924.

Occurrence.—Taken in small numbers in the North Temperate and Tropical Atlantic and off New Zealand to 52° 57′ S.

Remarks.—Length, ♀, 3·5–3·7 mm. (off New Zealand). I have retained the more familiar name of *Undeuchæta minor* for this species though the evidence is fairly strong that it was the male of this species that Lubbock (1856) described as *Undina plumosa*.

Records.—North Temp. Atlantic: 66 (*3*), 67 (*8*), 69 (*1*).—Tropical Atlantic: 64 (*20*), 65 (*26*).—**30°–40°** S.: 86 (*4*), 87 (*5*), 92 (*1**), 93 (*9*), 106 (*2*), 107 (*4*), 109 (*20*), 126 (*1**), 127 (*1*), 129 (*4*), 130 (*3*), 143 (*1*).—**50°–60°** S.: 235 (*18*), 236 (*5*), 238 (*31*), 240 (*2*), 241 (*26*).

58. *Undeuchæta major*, Giesbrecht.

Undeuchæta major, G. O. Sars, 1925.

Occurrence.—Two specimens were taken in the Tropical Atlantic, two off New Zealand, and one in 68° 37′ S., all in surface hauls.

Records.—Tropical Atlantic: 65 (*2*).—**30°–40°** S.: 106 (*2*).—**66° 30′–76°** S.: 269 (*1*).

59. *Chirundina Streetsi*, Giesbrecht.

Chirundina Streetsi, G. O. Sars, 1925.

Occurrence.—One specimen, stage V, in a surface haul off North Island, New Zealand.

Remarks.—Length, stage V, ♀, 4·15 mm. The fifth thoracic segments, as With has remarked, are produced into sharper points than in the adult.

Record.—**30°–40°** S. : 93 (*1*).

60. *Euchirella rostrata* (Claus).

Euchirella rostrata, G. O. Sars, 1925.

Occurrence.—Common off New Zealand, as far as 52° 11′ S.

Remarks.—Length, ♀, 3·15–3·4 mm. This species is more definitely epiplanctonic than any other in the genus and consequently is more numerously represented in the collection. The New Zealand form does not apparently differ from that of the North Atlantic.

Records.—**30°–40°** S. : 92 (*2**), 93 (*23*), 100 (*2*), 112 (*2*), 114 (*1**), 118 (*2*), 120 (*210*), 126 (*35*), 127 (*150*), 129 (*13*), 130 (*18*), 131 (*64*), 133 (*22*), 135 (*3*), 139 (*5*), 143 (*1*).—**50°–60°** S. : 238 (*1*), 240 (*1*).

61. *Euchirella brevis*, G. O. Sars.

Euchirella brevis, G. O. Sars, 1925.

Occurrence.—A few specimens were taken in three surface hauls off North Island, New Zealand.

Remarks.—Length, ♀, 3·96 mm., stage V, 3·12 mm., stage IV, 2·16–2·28 mm. The stout, almost globose, form of this species, with its short strong rostrum and very short abdomen, is unmistakable. It was described by Sars from the Azores and Canaries and he has also included the Australian Archipelago in his list of localities.

Records.—**30°–40°** S. : 92 (*2**), 130 (*2*), 131 (*5*).

62. *Euchirella latirostris*, n. sp. Fig. 7.

Description.—Female, length, 5·4 mm., cephalothorax 4·5 mm., abdomen 0·9 mm., cephalothorax uniformly oval in dorsal view (fig. 7 *b*), without crest or vaulting, segmentation between cephalon and first thoracic segment indicated dorsally, fifth thoracic segment not visible. Rostrum (fig. 7 *c*) single, moderately long, stout and with a broad base in lateral view. Abdomen symmetrical, one-fifth of the length of the cephalothorax. Genital segment equal in dorsal view to the three following segments, and about as long as wide in both dorsal and lateral view. Three following segments of equal length. Furcal rami as broad as long, divergent.

Antennules about as long as the whole body, type of jointing as in *E. rostrata*.

Antennæ (fig. 7 *d*) with endopodite slightly more than half as long as the exopodite and bearing 6+8 moderately stout and setose setæ, exopodite of antennæ with three terminal setæ and four setæ arising from the median joints ; all these setæ are stout and densely setose. Mandibles, first and second maxillæ and maxillipedes similar to those of *E. rostrata*. Swimming feet (fig. 7 *e, f*) as in *E. rostrata ;* the first basal joint of the fourth foot has on its inner face (fig. 7 *g*) a transverse row of six sharp triangular spines in a diminishing series, the first being much the largest, followed by two or three very minute spinules (not shown in the figure).

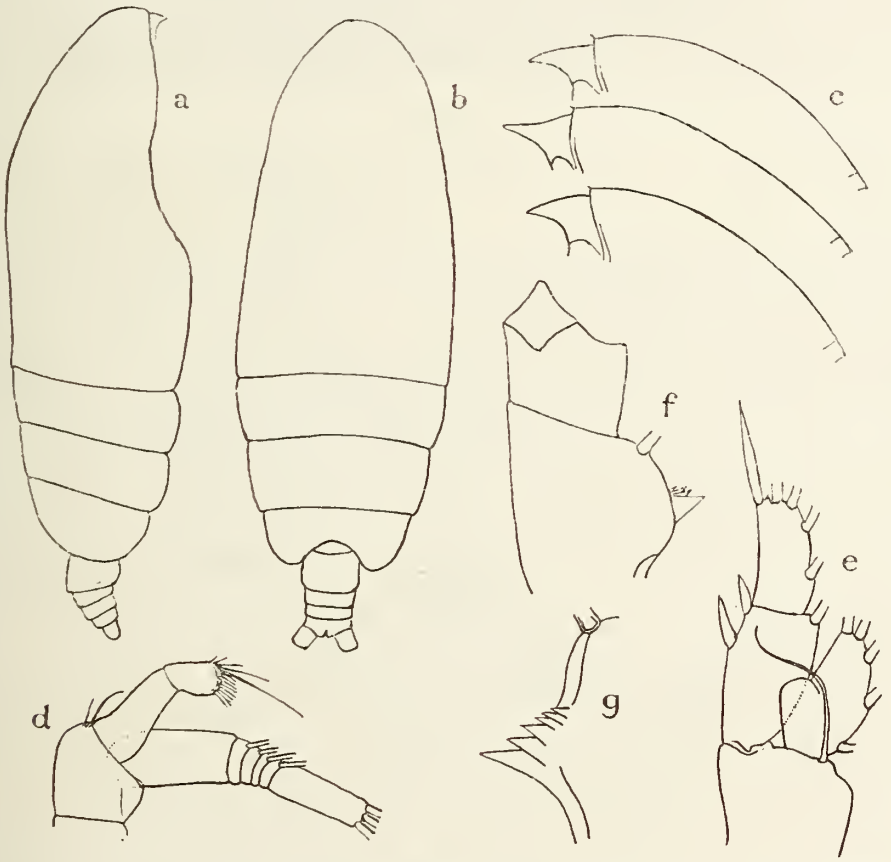

Fig. 7.—*Euchirella latirostris*, n. sp. Female : *a*, lateral view, × 15 ; *b*, dorsal view, × 15 ; *c*, rostrum (three specimens) ; *d*, antenna ; *e*, first foot, × 60 ; *f*, fifth foot, basal joints, × 60 ; *g*, inner edge spines of first basal joint of fifth foot, × 120.

Occurrence.—Three females in a haul at 80 metres in 52° 11′ S.

Remarks.—This species is closely allied to *E. rostrata* and differs mainly in its larger size and shorter and stouter rostrum. It also resembles the following species, *E. rostromagna*, in form and size and in many details, the most noticeable characters by which it may be distinguished being the form of the rostrum and the densely-feathered setæ on the antenna. The spines on the second basal joint of the 4th foot are also more sharply pointed than in *E. rostromagna*.

There was some variation in the form of the rostrum in the three specimens found (fig. 7 *c*). The lowermost specimen in the figure is the one whose appendages were mounted for examination.

Record.—**50°–60°** S. : 236 (*3*).

63. *Euchirella rostromagna*, Wolfenden. Fig. 8.

Euchirella rostromagna, Wolfenden, 1911.

Occurrence.—In the Antarctic in two horizontal hauls at 80 metres and 160 metres and in three vertical hauls from 500, 1000, and 1750 metres.

Remarks.—Length, ♀, 5·52–6·2 mm., ♂, 5·3 mm. Although Wolfenden has given no figures of this species his description clearly indicates its characteristics.

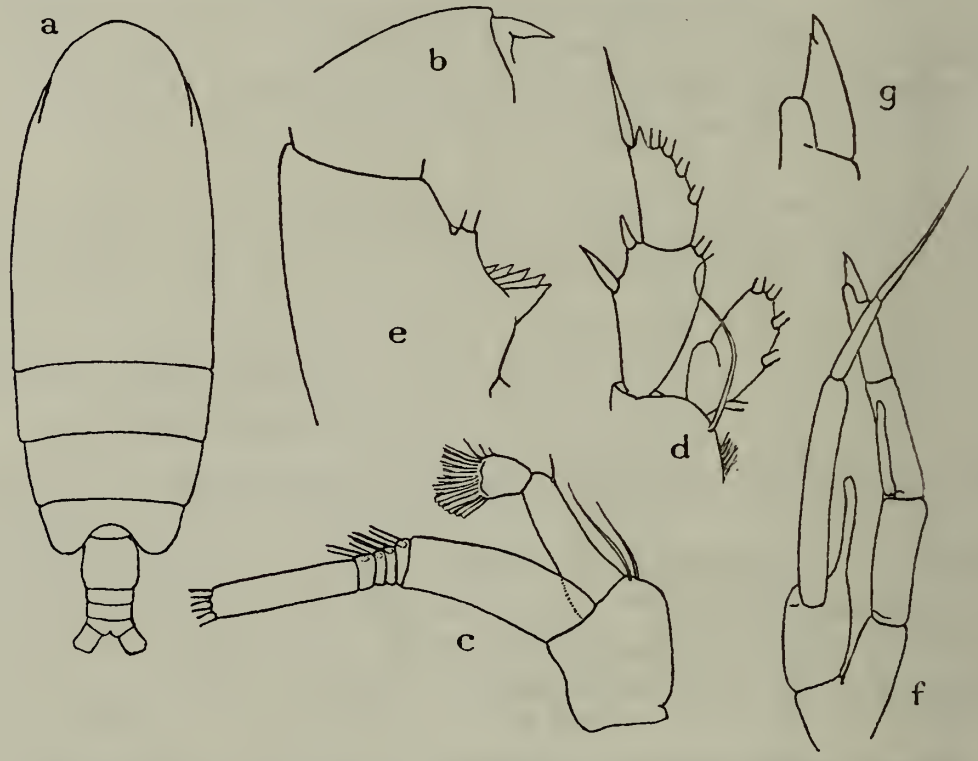

Fig. 8.—*Euchirella rostromagna*. Female : *a*, dorsal view, × 15 ; *b*, rostrum ; *c*, antenna, × 45 ; *d*, first foot ; *e*, first basal joint of fifth foot, × 79. Male : *f*, fifth feet, × 54 ; *g*, terminal portion of right fifth foot.

The long, slightly depressed rostrum (fig. 8 *b*), and the row of about eleven spines (fig. 8 *c*), the outermost with a very broad base and the five innermost very slender, on the 1st basal of the 4th foot are sufficient to distinguish it. Two males were taken in the vertical haul from 1000 metres. Length of abdomen $4\frac{1}{2}$ times in that of cephalothorax, body rather more slender than that of female with rostrum of the same type but slightly stronger. Fifth feet (fig. 8 *f*) resemble those of *E. rostrata*, but the terminal seta of the left foot and the endopodite of the right are much longer in proportion.

Records.—**66° 30′–76°** S. : 178 (*1*), 275 (*1*), 276 (*3*), 281 (*1*), 282 (*2*).

64. *Euchirella venusta*, Giesbrecht.

Euchirella venusta, Giesbrecht, 1892.

Occurrence.—Taken in small numbers in surface hauls on three stations off New Zealand.

Remarks.—Length, ♀, 4·62–5·0 mm. The deep dorso-lateral transverse groove on the left side of the genital segment of the female distinguishes this species from others with one or two strong spines on the 1st basal of the 4th foot. The abdomen of the "Terra Nova" specimens was shorter, probably owing to telescoping of the second and third segments, than is shown in Giesbrecht's figure.

Records.—30°–40° S.: 106 (*6*), 127 (*1**), 130 (*4*).

65. *Euchirella hirsuta*, Wolfenden.

Euchirella hirsuta, Wolfenden, 1911.

Occurrence.—One specimen in a vertical haul from 1760 metres in the Antarctic.

Remarks.—Length, V ♂, 7·3 mm. The large size, slender form, marked segmentation between the 4th and 5th thoracic segments and the hirsute 5th thoracic segment readily identify it. There is a small spine partially concealed by hairs on the posterior margin of the 5th thoracic segment on each side.

Record.—66° 30′–76° S.: 276 (*1**).

66. *Euchæta marina* (Prestand).

Euchæta marina, Giesbrecht, 1892.

Occurrence.—This common tropical species was taken plentifully in the Atlantic between 29° 10′ N. and 35° 29′ S., but was not met with elsewhere.

Records.—North Temp. Atlantic: 18 (*92*), 19 (*3*), 66 (*1310*), 67 (*300*), 68 (*1460*), 69 (*38*).—Tropical Atlantic: 39 (*62*), 40 (*20*), 43 (*5**), 50 (*600*), 52 (*120*), 53 (*40*), 56 (*5*), 57 (*30*), 58 (*650*), 59 (*1730*), 61 (*210*), 62 (*20*), 63 (*270*), 64 (*160*), 65 (*97*).—South Temp. Atlantic: 311 (*5*).

67. *Euchæta acuta*, Giesbr.

Euchæta acuta, Giesbrecht, 1892.

Occurrence.—This was the commonest species of *Euchæta* found off North Island, New Zealand, and was usually taken in company with *Euchæta media*. It was not possible to distinguish between the immature specimens of these species, and in estimating the totals on each station they have been allotted in the proportion in which the adults were present. *E. acuta* was not taken south of 34° 40′ S.

Records.—30°–40° S.: 80 (*8*), 84 (*45*), 85 (*210*), 86 (*1540*), 87 (*47*), 89 (*38*), 92 (*114*),

93 (*1740*), 100 (*2*), 106 (*1*), 107 (*46*), 109 (*16*), 120 (*545*), 122 (*2*), 127 (*244*), 128 (*1*), 129 (*9*), 130 (*36*), 139 (*2*).

68. *Euchæta media*, Giesbr.

Euchæta media, Giesbrecht, 1892.

Occurrence.—Almost as common as *E. acuta* off North Island, New Zealand, and, like it, with a range extending from 34° to 34° 40′ S.

Records.—**30°–40°** S.: 80 (*1*), 84 (*35*), 85 (*60*), 86 (*277*), 89 (*7*), 92 (*23*), 93 (*750*), 100 (*2*), 106 (*1*), 107 (*24*), 120 (*1470*), 122 (*3*), 127 (*22*), 129 (*3*), 130 (*9*), 131 (*8*), 133 (*9*), 139 (*1*).

Euchæta acuta+media (*immature*).

Records.—**30°–40°** S.: No adult was taken on the following stations: 73 (*1*), 81 (*1*), 94 (*1*), 97 (*3*), 118 (*1*), 126 (*1*), 132 (*1*).

69. *Euchæta pubera*, G. O. Sars.

Euchæta pubera, G. O. Sars, 1925.

Occurrence.—In small numbers off North Island, New Zealand.

Remarks.—Length, ♀, 3·95–4·2 mm. I think Sars was wrong in including *E. Wolfendeni*, Scott, in the synonomy of this species. *E. pubera* is a much larger and more robust species with the genital segment of a very different shape, as can be seen by comparing Sars' and Scott's (1909) figures. In particular it lacks the small globular tubercle on the right side of the genital segment which characterises *E. Wolfendeni*.

Records.—**30°–40°** S.: 86 (*3*), 89 (*3*), 92 (*1**), 93 (*2*), 107 (*1**), 110 (*1*), 127 (*2**), 131 (*8*), 135 (*3*), 139 (*1*).

70. *Euchæta longicornis*, Giesbr.

Euchæta longicornis, Giesbrecht, 1892.

Occurrence.—One female was taken in a surface haul off North Island, New Zealand.

Remarks.—Length, ♀, 2·9 mm. The long antennules, reaching to the furca, and the swollen protuberance on the right side of the genital segment afford ready means of identification.

Record.—**30°–40°** S.: 89 (*1*).

71. *Pareuchæta antarctica* (Giesbr.).

Euchæta antarctica, Giesbrecht, 1902.

Occurrence.—Common from the Antarctic Circle southwards, especially in hauls made under the ice at Cape Evans.

Records.—**66° 30′–76°** S.: 172 (*36*), 177 (*18*), 178 (*3*), 180 (*90*), 224 (*1*), 272 (*21*),

274 (*2*), 275 (*6*), 276 (*6*), 281 (*515*), 282 (*2*), 284 (*7*), 285 (*2*), 288 (*80*).—**76°–78°** S. : 317 [6 (*1*), 7 (*8*), 11 (*46*), 15 (*20*), 18 (*5*), 19 (*1*), 22 (*5*), 23 (*1*), 24 (*24*), 25 (*3*), 29 (*1*)], 318 (*abd.*), 342 (*2*), 343 (*15*), 344 (*10*), 345 (*9*), 350 (*10*), 351 [61 (*13*), 62 (*23*), 63 (*29*), 64 (*13*), 65 (*8*)], 352 (*1*).

72. *Pareuchæta similis* (Wolfenden).

Euchæta similis, Wolfenden, 1911.

Occurrence.—Found, like *P. antarctica*, chiefly under the ice at Cape Evans but much scarcer than that species and with a more restricted range.

Remarks.—Length, ♀, 10 mm. The shape of the genital boss, arising from the posterior end of the genital segment and directed forwards, is characteristic.

Records.—**76°–78°** S. : 317 [7 (*7*), 11 (*6*)], 318 (*1*), 343 (*1*), 351 [61 (*1*), 63 (*1*), 65 (*1*)].

73. *Pareuchæta Erebi*, n. sp. Fig. 9.

Description.—Female, length, 9·2–9·5 mm., cephalothorax 6·5 mm., abdominal segments and furca 2·64 mm. in the proportion 1·08, 0·66, 0·64, 0·06, 0·30. Rostrum (fig. 9 *c*) short and stout, rather blunt and not directed forwards. Lateral margins of last thoracic segment setose, the postero-ventral setæ being the longest and the setæ being continued round to the postero-dorsal margin. Genital segment (fig. 9 *a*, *b*) of the same type as in *P. similis*, the genital boss having the right lateral plate longer than the left making the genital aperture appear as if placed diagonally. The genital boss has a more rectangular lateral outline than in *P. similis* and arises from the middle of the genital segment instead of from its posterior half. There is a small papilla at the base of the genital boss on the left side posteriorly. The ventral surfaces of the second and third abdominal segments are sparingly setose. The furca (fig. 9 *d*) is short with setose margins. The first, third, and fourth furcal setæ, counting from within, are of equal length, about

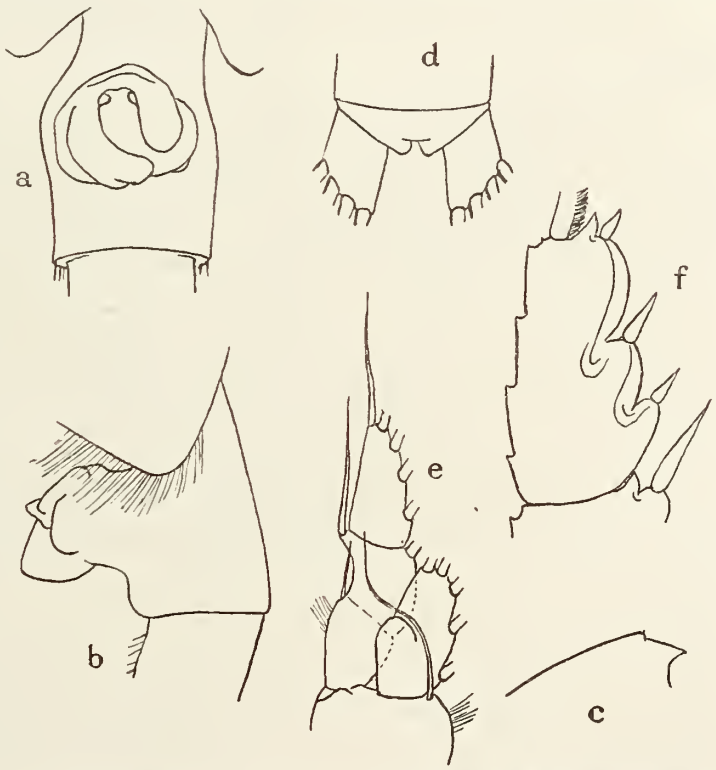

Fig. 9.—*Pareuchæta Erebi*, n. sp. Female : *a*, genital segment, ventral view ; *b*, genital segment, lateral view ; *c*, rostrum ; *d*, furca ; *e*, first foot, × 54 ; *f*, third joint, of exopodite of second foot × 54.

1·6 mm., the second seta is very long, about 3·9 mm., and the appendicular seta is of moderate length, about 2·2 mm. The first antenna reaches almost to the end of the cephalothorax. The exopodite of the first foot (fig. 9 *e*) has the first and second segments almost completely fused, the outer edge spine at the junction reaching almost to the end of the second segment. The outer edge spine on the second segment reaches well beyond the end of the third segment.

Occurrence.—Taken on three successive days, May 20, 21, and 22, 1912, at 50, 100, and 150 metres on Station 351 in townettings taken through a hole in the ice at Cape Evans, five females in all.

Remarks.—Apart from other characters the form of the genital boss is sufficient to distinguish this species from *Pareuchæta similis* which it most resembles.

Records.—**76°–78°** S.: 351 [63 (*2*), 64 (*1*), 65 (*2*)].

74. *Pareuchæta Farrani* (With).

Euchæta Farrani, With, 1915.

Occurrence.—One specimen in a vertical haul from 1000 metres within the Antarctic Circle.

Remarks.—Length, ♀, 11·0 mm. Two species of *Pareuchæta* with a genital segment of the *P. barbata* type have been described as having a tubercle on the left side of the genital boss, viz. *P. barbata*, as identified by me (1908) and accepted by With and Sars, and *P. Farrani*, described by With. The specimen here recorded agrees with *P. Farrani* both in size and in having the ventral surface of the second and third abdominal segments beset with tufts of setæ. The genital segment agrees in lateral view but the form of the accessory plates does not correspond exactly. The exact structure of these plates is, however, difficult to make out and a very close correspondence need not be expected, as may be seen by comparing With's and Sars' figures in the case of allied species. The exopodite of the 1st foot has the articulation between the first and second joints very faintly indicated so that it appears to be two-jointed, and the outer edge spines on the first and second joints are much smaller than in With's figure of this appendage, that on the first joint being very minute. The third joint of the exopodite of the 2nd foot has a deep notch between the second and third outer edge spines, reaching back to the middle of the joint. The first outer edge spine is small, the second comparatively large but not reaching to the base of the third. The rostrum is slender and is noticeably directed forwards, as in Sars' (1903) figure of *Euchæta barbata*, which With considers to be the same as *P. Farrani*.

Record.—**66°–30′–76°** S.: 282 (*1*).

75. *Pareuchæta rasa*, n. sp. Fig. 10.

Description.—Female, length 5·8–6·0 mm., cephalothorax 4·0 mm., abdomen and furca (fig. 10 *c*) 1·8 mm., in the proportion 0·66, 0·42, 0·40, 0·06, 0·26. Rostrum (fig. 10 *a*) moderately slender, acute, not directed forwards. Last thoracic segment with the

usual ventrally directed setose tuft. Genital boss (fig. 10 *b*) almost as in *P. barbata* with lateral flaps not quite symmetrical, that on the right being more rounded than that on the left. No definite structures could be made out, even after dissection, between the flaps except (fig. 10 *d*) a straight transverse chitinous ridge, but there are some ill-defined chitinous thickenings on each side as indicated in fig. 10 *d*. At the base of the genital boss on the left side posteriorly there is a chitinous ridge or thickening, not amounting to a papilla and on the same side anteriorly a somewhat similar but less evident ridge. The ventral surfaces of the second and third abdominal segments have a few scattered hairs. The furcal rami are a little longer than broad.

The first foot (fig. 10 *e*) has the first and second joints of the exopodite almost

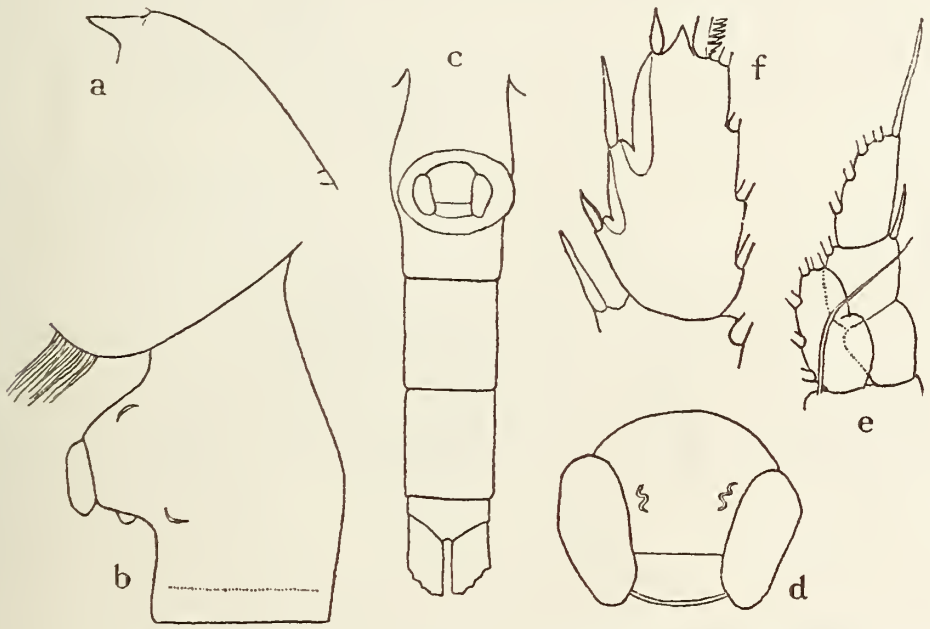

Fig. 10.—*Pareuchæta rasa*, n. sp. Female: *a*, rostrum; *b*, genital segment, lateral view; *c*, abdomen, ventral view, × 37; *d*, genital plates, ventral view; *e*, first foot; *f*, third joint of exopodite of second foot.

completely fused, the junction being very faintly indicated. The outer edge seta of the first joint was not observed. The outer edge seta of the second joint only reaches a little past the middle of the third joint. The third joint of the exopodite of the second foot (fig. 10 *f*) has well-developed outer edge spines, the second spine reaching almost to the base of the third. The notch between the second and third spines is wide but not very deep.

Occurrence.—In vertical hauls from between 500 and 1000 metres in the Antarctic, nine specimens in all being taken.

Remarks.—It does not seem possible at present to identify this species with any previously described. *P. affinis* Cleve (1905) from 900 metres in the Agulhas current, off South Africa, agrees in size but seems to have the genital flaps much less developed.

P. Scotti also agrees in size but, as With's figure shows, its genital aperture has a complicated series of plates.

Records.—66°–30′–76° S.: 178 (*1*), 282 (*6*), 285 (*2*).

76. *Pareuchæta biloba*, n. sp. Fig. 11.

Description.—Female, length 5·3–5·9 mm., cephalothorax 3·3 mm., abdomen 2·0 mm., abdominal segments and furca in the proportion 3·3, 0·72, 0·48, 0·5, 0·03, 0·27.

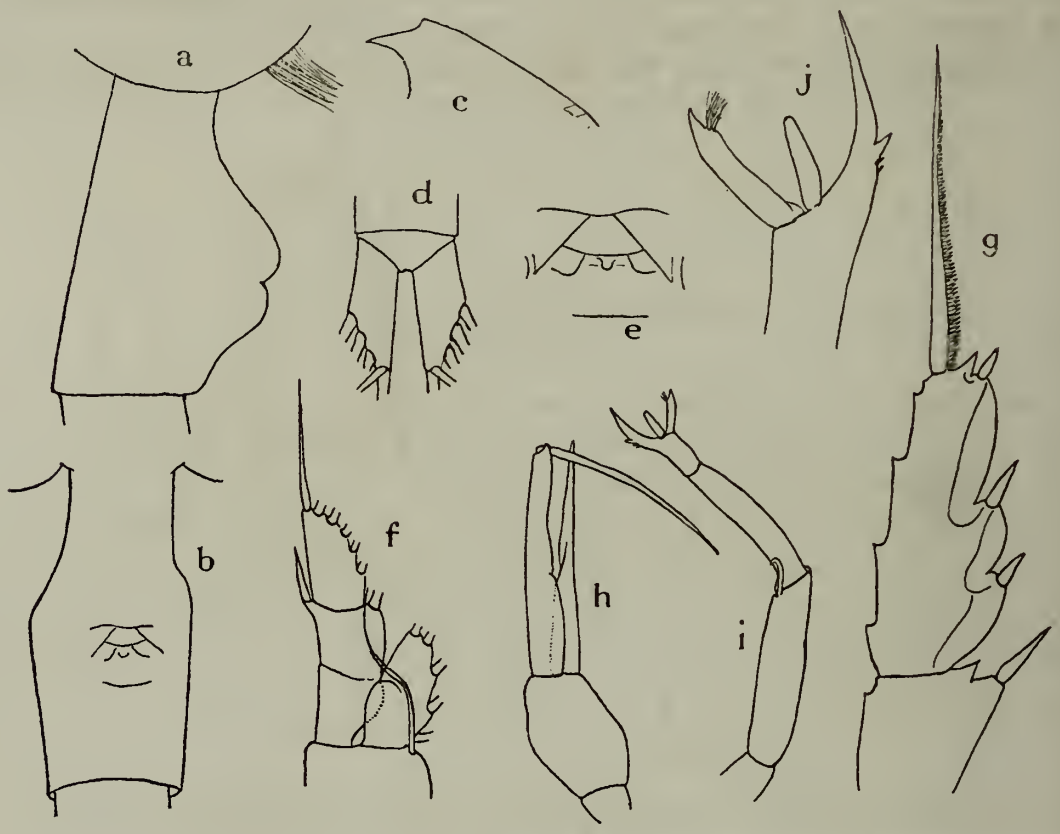

Fig. 11.—*Pareuchæta biloba*, n. sp. Female: *a*, genital segment, lateral view; *b*, genital segment, ventral view; *c*, rostrum; *d*, furca; *e*, genital plates, ventral view; *f*, first foot, × 84; *g*, second and third joints of exopodite of second foot, × 84. Male: *h*, right fifth foot; *i*, left fifth foot; *j*, terminal joints of left fifth foot, × 90.

Rostrum (fig. 11 *c*) moderately slender, not directed forwards. Last thoracic segment with a small tuft of long setæ on the postero-lateral margin. Genital segment (fig. 11 *a*, *b*) with comparatively flattened genital boss, bilobed in lateral view, genital plates feebly developed, having the arrangement shown in fig. 11 *c*. Second and third abdominal segments smooth, the third slightly longer than the second, anal segment very short, furca about twice as long as broad, furcal setæ short except the appendicular seta which is very long.

First foot (fig. 11 *f*) with first and second joints of the exopodite almost completely fused; no outer-edge seta was seen on the first joint but the outer-edge seta of the

second joint almost reaches to the end of the third joint. Third joint of the exopodite of the second foot (fig. 11 *g*) with moderately deep notch between the second and third outer-edge spines ; the second outer-edge spine is short, reaching only half-way to the base of the third.

Male, length 4·8–4·9 mm., without distinctive characters except the form of the fifth feet (fig. 11 *h*, *i*, *j*).

Occurrence.—Taken in moderate numbers off the Auckland and Campbell Islands in hauls between the surface and 30 metres. One specimen was taken within the Antarctic Circle in a surface haul.

Remarks.—This seems to be a characteristic epiplanctonic sub-antarctic form. It may be expected to have a circumpolar range though it does not seem to have been noticed by any previous expedition.

Records.—**50°–60°** S. : 235 (*15*), 238 (*21*), 240 (*6*), 241 (*130*).—**66° 30′–76°** S. : 269 (*1*).

77. *Scolecithrix Danæ* (Lubb.).

Scolecithrix Danæ, Giesbrecht, 1892.

Occurrence.—This common tropical form occurred from 29° 10′ N. to 35° 89′ S. in the Atlantic, and on a few stations off North Island, New Zealand.

Records.—North Temp. Atlantic : 18 (*1*), 66 (*60*), 67 (*48*), 68 (*72*), 70 (*1*).—Tropical Atlantic : 39 (*60*), 40 (*5*), 43 (*5*), 50 (*10*), 52 (*19*), 53 (*120*), 58 (*53*), 59 (*280*), 61 (*20*), 62 (*7*), 63 (*80*), 64 (*22*), 65 (*20*).—South Temp. Atlantic : 311 (*79*).—**30°–40°** S. : 85 (*2*), 86 (*4*), 87 (*1*), 93 (*8*), 133 (*1*).

78. *Scolecithrix Bradyi*, Giesbr.

Scolecithrix Bradyi, Giesbrecht, 1892.

Occurrence.—Taken on two stations off North Island, New Zealand.

Records.—**30°–40°** S. : 86 (*1*), 87 (*5*).

79. *Scolecithrix polaris*, Wolfenden. Fig. 12.

Scolecithrix polaris, Wolfenden, 1911.

Occurrence.—In two vertical hauls, from 1000 and 1750 metres, in the Antarctic, only immature specimens in the former.

Remarks.—Length, ♀, 4·38 mm. Wolfenden has noted the resemblance of this species to *S. valida*, and it is remarkable that both species should have occurred together on Station 282. The most readily observed difference without mounting the appendages was on this occasion the slightly shorter abdomen and furca of *S. polaris*, contained about $4\frac{1}{2}$ times in the length of the cephalothorax. In *S. valida* it was slightly more than a quarter the length of the cephalothorax. Wolfenden in his description does not

mention the terminal spines of the swimming feet; they are of the same type as in *S. valida*, the teeth being partially fused into a lamina. The teeth are slightly more numerous, forty or more, and longer than in *S. valida* and the whole spine is broader. The outer edge spines of the exopodite of the first foot (fig. 12 *a*) were noticeably shorter than in *S. valida*, and the outer edge spine of the first joint of the exopodite of the second foot (fig. 12 *b*) was short and straight, not curved as in *S. valida*, a character of considerable specific value.

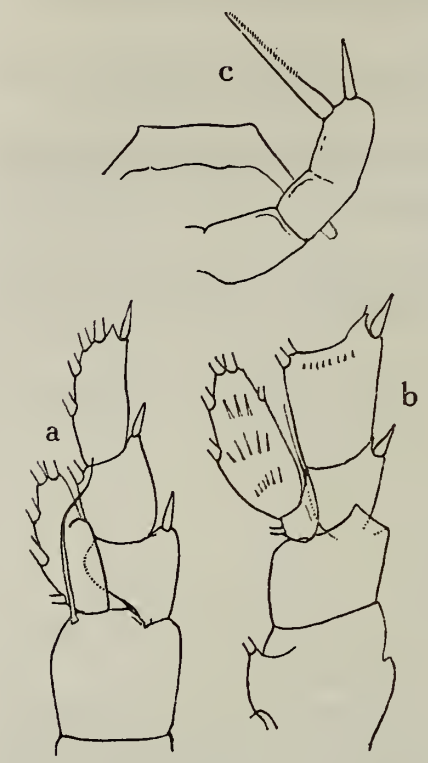

Fig. 12.—*Scolecithrix polaris*. Female: *a*, first foot, × 90; *b*, second foot, part, × 65; *c*, fifth foot, × 132.

Records.—66° 30′–76° S: ? 276 (*2**), 282 (*2*).

80. *Scolecithrix valida*, Farran.

Scolecithrix valida, Farran, 1908, With, 1915.

Occurrence.—Two females in a vertical haul from 1750 metres in the Antarctic.

Remarks.—Length, ♀, 4·06 mm. These specimens appear to be identical with those from off the west coast of Ireland.

It is improbable that Sars' record (1925) refers to this species. His specimen only measured 2·1 mm., and had a large curved spine on the first point of the exopodite of the 2nd foot. In *S. valida* this spine though curved is much shorter than in Sars' figure. In these points and also to some extent in the form of the fifth feet Sars' specimen resembled *Scolecithrix falcifer* (Farran, 1926).

Record.—66° 30′–76° S.: 282 (*2*).

81. *Scolecithrix incisa*, n. sp. Fig. 13.

Description.—Female, length 3·18 mm. Cephalothorax 2·46 mm., abdomen and furca 0·72 mm. in the proportion 30, 15, 13, 4, 11. Cephalothorax (fig. 13 *a*, *b*) oval, slightly tapered anteriorly in dorsal view, cephalon not vaulted. Fifth thoracic segment showing as a narrow band beyond the fourth. Genital segment not swollen ventrally, furca a little longer than broad. Length of joints of antennule in 0·01 mm.

1	2	3	4	5	6	7	8–9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24–25
36	25	16	16	14	14	15	30	13	21	24	31	31	29	28	27	27	26	30	29	25	31	28

Median and distal setæ were present on the 14th and 18th joints.

Endopodite of 2nd antenna contained $1\frac{3}{4}$ times in the length of the exopodite. Other mouth appendages as in *S. ovata*; 1st foot (fig. 13 *c*) with moderately long slender outer edge setæ on all the joints of the exopodite. First basal joints of 2nd and 3rd

(fig. 13 *e*) feet with well-marked notch on the outer margin. First basal joint of the 4th foot (fig. 13 *f*) with straight outer margin ; inner margin very prominent with very small inner edge seta. Outer edge spine of first joint of exopodite of 2nd foot (fig. 13 *d*) straight and less than half as long as the second joint. Terminal spines of exopodite of 2nd foot with 38 fine short denticulations, fully separated, of 3rd foot (fig. 13 *g*) with 40 such denticulations. Fifth feet (fig. 13 *h*) three-jointed, third joint as long as

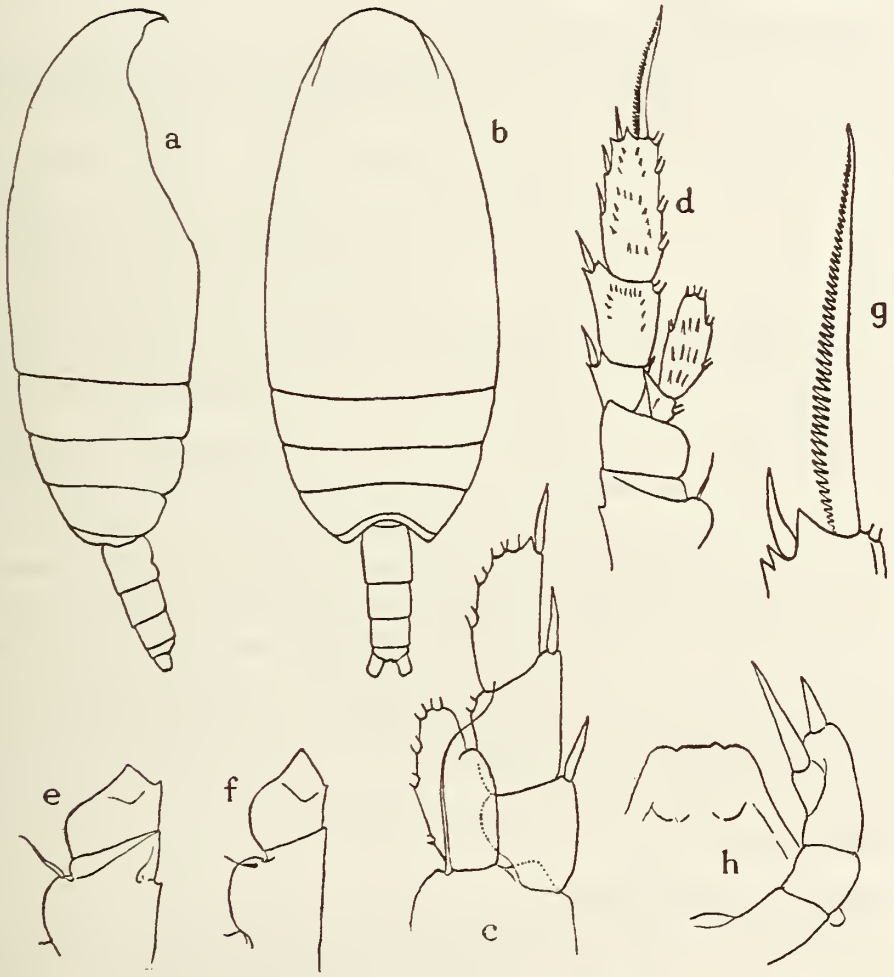

Fig. 13.—*Scolecithrix incisa*, n. sp. Female : *a*, dorsal view, × 27·5 ; *b*, lateral view, × 27·5 ; *c*, first foot, × 148 ; *d*, second foot, × 62 ; *e*, third foot, basal joints, × 62 ; *f*, fourth foot, basal joints, × 62 ; *g*, terminal spine of third foot, × 148 ; *h*, fifth foot.

combined first and second joints, with short terminal spine and sub-terminal inner edge spine about twice as long as the terminal spine ; proximal to the sub-terminal spine there is a fold or ridge along the inner face of the joint.

Occurrence.—One specimen in a haul made under the ice off Cape Evans.

Remarks.—This species is allied to *S. polaris* and belongs like it to the same section of the genus as *S. laminata*, *S. emarginata*, and *S. ovata*, in which the first basal of the

2nd and 3rd feet has a notch on the outer margin and the outer edge spine of the first joint of the exopodite of the second foot is straight. It can be distinguished from *S. polaris* by the shorter denticulations on the terminal spines of the swimming feet and the much longer outer edge spines on the exopodite of the 1st feet.

Record.—**76°–78°** S. : 351 [65 (*1*)].

82. *Scolecithrix robusta*, T. Scott.

Scolecithrix robusta, T. Scott, 1893.

Occurrence.—In a vertical haul from 1000 metres in the Antarctic, three females and three specimens in stage V.

Remarks.—Length, ♀, 2·58 mm., cephalothorax, 2·04 mm., abdomen 0·54 mm. The antennules reach to the middle of the abdomen, on their 14th, 17th, and 18th joints are two setæ. The outer edge spines of the exopodite of the first foot are very slender and moderately long. The first joint of the exopodite of the second foot is long and curved ; the terminal spine of the exopodite has about 32 teeth, all counted, which are short and set diagonally on the distal three-fourths of the spine. There is no notch on the outer margin of the second and third feet. The fifth feet are of the same type as in T. Scott's figure but show some variations, in one specimen the third joint is broader than the second, in another it is narrower, as in Scott's figure, but the second joint on both sides bears a rudimentary endopodite. The large inner edge spine of the third joint in all the specimens is coarsely toothed and slightly curved especially towards the tip. These specimens appear to be identical with those which I have referred (1908) to this species from the west coast of Ireland, and probably also with those recorded by With (1915), though he does not mention the presence of two setæ on the 18th joint of the antennules when referring to them on the 10th and 17th joints.

Record.—**66° 30′–76°** S. : 282 (*6*).

83. *Scolecithrix ovata*, Farran.

Scolecithrix ovata, Farran, 1905.

Occurrence.—In four vertical hauls from 500 metres or more and in a horizontal haul at 60 metres in the Antarctic. A doubtful record from off New Zealand in a surface haul.

Remarks.—Length, ♀, 2·04–2·16 mm. Abdomen and furca about one-fourth as long as the cephalothorax. The specimen from off New Zealand measured only 1·82 mm. In appearance it closely resembled the typical *S. ovata* except that the abdomen and furca only measured one-fifth of the cephalothorax and the notch in the fifth thoracic segment was deeper. Unfortunately in mounting the specimen the 5th feet were not found. The other appendages agreed closely with *S. ovata* except that the teeth on the terminal spines of the exopodites of the swimming feet were not so numerous, the 2nd feet had spines with 30 and 31 teeth as compared with 40 or more in *S. ovata*, the most minute

teeth being counted. In the absence of the 5th feet it is not possible to decide whether this is a distinct species or an extreme form of *S. ovata*.

Records.—30°–40° S. : 87 (*? 1*).—66° 30′–76° S. : 178 (*3*), 276 (*4*), 282 (*12*), 285 (*6*), 288 (*1*).

84. *Scolecithricella dentata* (Giesbr.).

Scolecithrix dentata, Giesbrecht, 1892.

Occurrence.—Taken a few times in small numbers in the North Temperate and Tropical Atlantic and also off New Zealand.

Records.—North Temp. Atlantic : 68 (*1*).—Tropical Atlantic : 50 (*1*), 59 (*2*), 64 (*2*), 65 (*32*).—30°–40° S. : 84 (*1*), 86 (*1*), 87 (*1*), 97 (*5*), 114 (*10*), 117 (*1*).

85. *Scolecithricella minor* (Brady).

Scolecithricella minor, G. O. Sars, 1903.

Occurrence.—Taken on one station in the North Temperate Atlantic.

Records.—North Temp. Atlantic : 68 (*15*).

86. *Scolecithricella glacialis* (Giesbr.)

Scolecithrix glacialis, Giesbrecht, 1902.

Occurrence.—On a few stations between 51° 57′ S. and 66° 38′ S., in three hauls at the surface, one at 80 metres and one at 0–400 metres, in small numbers, except in one surface haul where it was moderately common.

Remarks.—Length, ♀, 1·2–1·41 mm. This species was first described from the "Belgica's" Antarctic collections by Giesbrecht and was recorded by Wolfenden from several of the "Gauss" stations. The "Belgica" records were from 69°–71° S., 400–475 m., and the "Gauss" records from about 65° S. in vertical hauls from 400 metres or more.

S. glacialis, ♀, differs very little from *S. minor*, the form of the last thoracic segment furnishing the most obvious distinction ; the 5th feet also differ slightly, being longer and narrower and not so rounded.

Records.—50°–60° S. : 241 (*1*), 251 (*1*), 305 (*90*).—60°–66° 30′ S. : 230 (*1*). 66° 30′–76° S. : 172 (*4*).

87. *Scolecithricella vittata* (Giesbr.).

Scolecithrix vittata, Giesbrecht, 1892.

Occurrence.—One specimen in a surface haul off New Zealand.

Remarks.—Length, ♀, 1·64 mm. The longest seta of the 5th foot was bent backwards in a characteristic way against the side of the genital segment.

Record.—30°–40° S. : 100 (*1*).

88. *Scaphocalanus affinis*, G. O. Sars. Fig. 14.

Scaphocalanus affinis, G. O. Sars, 1925.

Occurrence.—In the Antarctic in two vertical hauls from 1000 and 1750 metres.

Remarks.—Length, ♀, 5·05–5·10 mm., stage V, 3·96–4·44 mm. Although the size, 3·6 mm., given by Sars for this species is much less than that of the Antarctic specimens, I have recorded them under this name on account of the resemblance in the form of the body and of the 5th feet. The Antarctic specimens seem, however, to be somewhat stouter than that figured by Sars.

S. gracilis, described by Wolfenden (1911) from 1000 metres in the South Atlantic,

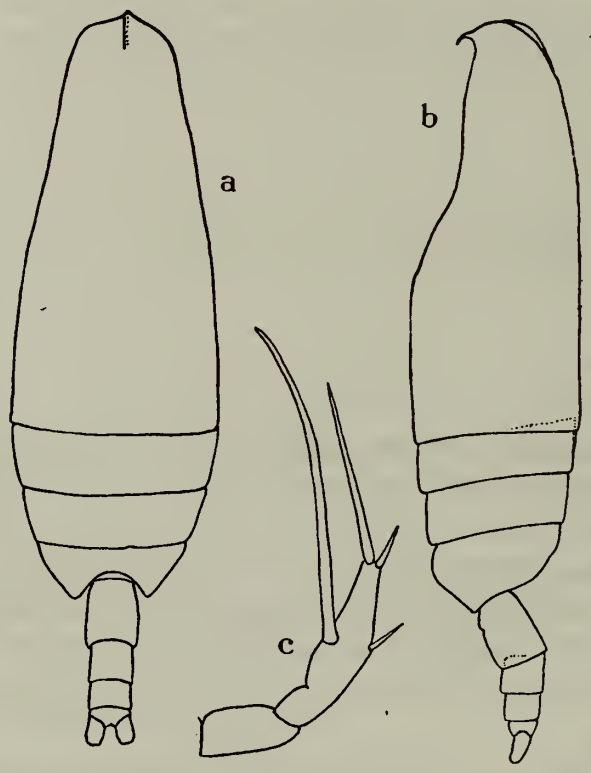

Fig. 14.—*Scaphocalanus affinis*. Female: *a*, dorsal view, × 165; *b*, lateral view, × 16 5; *c*, fifth foot.

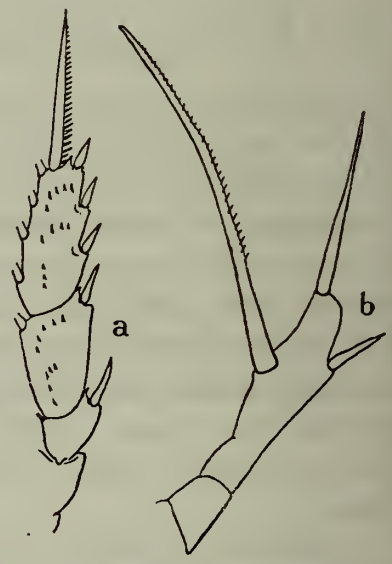

Fig. 15.—*Scaphocalanus brevicornis*. Female: *a*, exopodite of second foot; *b*, fifth foot, × 365.

measures 4·85 mm. and thus agrees more nearly in size but differs in the form of the 5th feet which have a much longer outer-edge spine. Sars considered it likely that *S. gracilis* and *S. affinis* were identical.

Records.—**66° 30′–76°** S.: 276 (*3*), 282 (*4*).

89. *Scaphocalanus brevicornis* (G. O. Sars). Fig. 15.

Amallophora brevicornis, G. O. Sars, 1903.

Occurrence.—In vertical nets in the Antarctic hauled from depths of from 400 to 1760 metres, several specimens.

Remarks.—Length, ♀, 2·4–2·62 mm. I have included under this name specimens which showed a good deal of variation in the form of the 5th foot in the female, but they all agreed in having a 5th foot with a long terminal seta and a much longer inner edge seta finely toothed on its distal side, the inner-edge seta reaching well beyond the end of the terminal seta. One of the extreme forms (fig. 15 *b*) comes very near to Wolfenden's (1911) figure of the 5th foot of *Amallophora impar*, but unlike that species it has the inner edge seta toothed only on the distal side. The outer-edge spine on the first joint of the exopodite of the 2nd foot (fig. 15 *a*) is almost half as long as the second joint and is slightly curved.

Records.—66° 30′–76° S.: 172 (*2*), 178 (*4*), 270 (*7*), 276 (*2*), 282 (*5*), 285 (*3*).

90. *Scaphocalanus sub-brevicornis* (Wolfenden). Fig. 16.

Amallophora sub-brevicornis, Wolfenden, 1911.

Occurrence.—Eight specimens in two vertical hauls, from 400 and 1000 metres.

Remarks.—Length, ♀, 1·91–1·94 mm., length of abdomen contained about $2\frac{2}{3}$ times in that of the cephalothorax, outer-edge spine of 1st joint of exopodite of 2nd foot comparatively short and not distinctly curved. Fifth feet differ from Wolfenden's figure in having a small tooth exterior to the base of the terminal spine.

This species differs very little from *Scolecithrix longifurca* of Giesbrecht, which is a true *Scaphocalanus*, and perhaps they should be joined. Specific characters common to the two species are the rather long abdomen, more than $\frac{1}{3}$ of the cephalothorax and the long anal segment and furca. In Giesbrecht's description he gives the total length as 1·75 mm., cephalothorax 1·3 abdomen 0·75 (an obvious misprint for 0·45). The fifth feet (fig. 16) are similar, assuming that in Giesbrecht's figure the inner edge seta has been twisted round so that the upper edge appears as the lower. Another difference is that in *S. sub-brevicornis* the endopodite of the 2nd antenna is said by Wolfenden to be longer than the exopodite, though in my specimens they are practically equal, in *S. longifurca* the exopodite is slightly the longer. The outer edge spine of the 1st joint of the exopodite of the 2nd foot (fig. 16 *a*) is shorter than that of the 2nd joint in both species; in *S. longifurca* it is described as "hackig," in *S. sub-brevicornis* it is straight or nearly so. The shortness of this spine distinguishes both these species from *S. brevicornis* and *S. echinatus*.

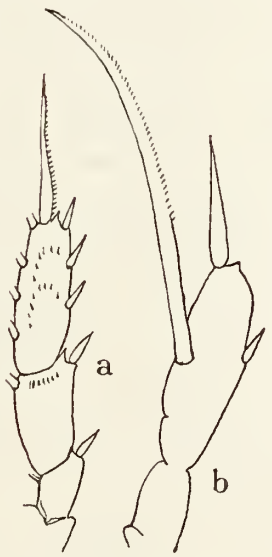

Fig. 16.—*Scaphocalanus sub-brevicornis.* Female: *a*, exopodite of second foot; *b*, fifth foot, × 375.

Records.—66° 30′–76° S.: 172 (*4*), 282 (*4*).

91. *Scaphocalanus echinatus* (Farran). Fig. 17.

Scolecithrix echinatus, Farran, 1905.

Occurrence.—One specimen from off North Island, New Zealand, and a few to the south of South Island, surface to 30 metres.

Remarks.—Length, ♀, 1·8 mm. (Station 87), 2·28–2·30 mm. (Stations 235, 238, 241). Fifth feet characterised by the coarse toothing of the inner-edge seta, which does not reach beyond the tip of the terminal seta, thus differing from those of *S. brevicornis* and *S. impar* in which the inner-edge seta is finely toothed and reaches beyond the tip of the terminal seta. The outer edge seta of the 1st joint of the exopodite of the 2nd foot is curved and about as long as the seta of the 2nd joint. It reaches to the middle of the outer edge of the 2nd joint. The specimen from Station 87 is much smaller than the rest but it agrees otherwise.

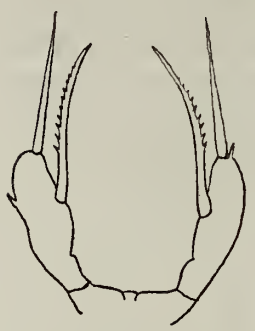

Fig. 17.—*Scaphocalanus echinatus*. Female from Stn. 87, fifth feet, × 300.

There is a small amount of variation in the form of the 5th feet. In the specimen from Station 87 (fig. 17) the outer-edge tooth was absent from one side and on the other side there was a small terminal tooth in addition to the terminal seta.

Records.—**30°–40°** S.: 87 (*1*).—**50°–60°** S.: 235 (*4*), 238 (*1*), 241 (*2*).

92. *Scaphocalanus curtus* (Farran).

Scolecithrix curta, Farran, 1926.

Occurrence.—Several specimens off New Zealand in a vertical haul 0–120 metres and horizontal hauls at from 2 to 30 metres.

Remarks.—Length, ♀, 0·96–1·18 mm. These specimens, which showed no trace of a fifth pair of feet, agreed well with those from the N.E. Atlantic.

In spite of the absence of a fifth pair of feet I have included this species in the genus *Scaphocalanus* on account of the agreement of its other characters.

Records.—**30°–40°** S.: 74 (*1*), 84 (*4*), 87 (*3*), 96 (*10*).

93. *Racovitzanus antarcticus*, Giesbr.

Racovitzanus antarcticus, Giesbrecht, 1902.

Occurrence.—Frequent in the Antarctic in vertical hauls made to the surface from depths between 400 and 1000 metres. One specimen was taken at the surface to the S.W. of South Island, New Zealand, probably a drifted individual, and one under the ice off Cape Evans.

Remarks.—Length, ♀, 2·13–2·42 mm. As Wolfenden has pointed out, the small endopodite found on the 5th pair of feet of Giesbrecht's original specimen is not normally present.

Records.—**50°–60°** S.: 252 (*1*).—**66° 30′–76°** S.: 172 (*1*), 177 (*6*), 178 (*5*), 270 (*21*), 282 (*11*), 285 (*16*).—**76°–78°** S.: 317 [18 (*1*)].

94. *Scottocalanus securifrons* (T. Scott).

Scottocalanus securifrons, G. O. Sars, 1925.

Occurrence.—Two specimens in surface hauls off New Zealand, one by day and one by night.

Remarks.—Length, ♀, 3·88–4·5 mm. Apparently identical with the North Atlantic form.

Records.—30°–40° S.: 100 (*1*), 129 (*1*).

95. *Scottocalanus terranovæ*, n. sp. Fig. 18.

Description.—Female, length 3·84–3·9 mm., cephalothorax 3·36 mm., abdomen

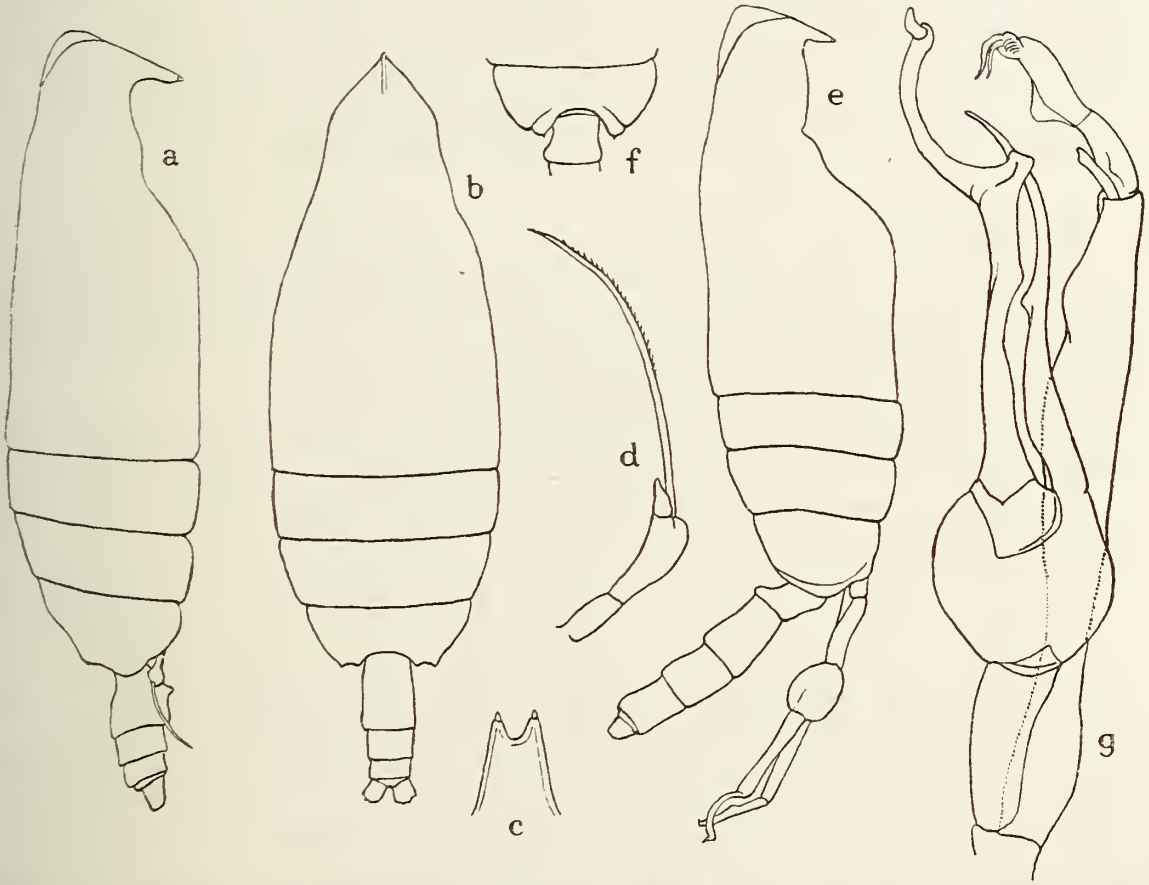

Fig. 18.—*Scottocalanus terranovæ*, n. sp. Female: *a*, lateral view, × 26; *b*, dorsal view, × 25·5; *c*, rostrum, anterior view, × 68; *d*, fifth foot, × 98. Male: *e*, lateral view, × 27; *f*, fourth and fifth thoracic segments, dorsal view, × 27; *g*, fifth feet, × 79.

0·52 mm., crest well developed, rostrum (fig. 18 *c*) with short rami and small apical spines, fifth thoracic segment rounded in lateral view as in *S. Thori*, but in dorsal view constricted so as to give the appearance of a short sharp spine on each side, abdomen with slight genital swelling, resembling that of *S. Thori* in proportion and outline.

Antennules, antennæ, mouth appendages and swimming feet as in *S. Thori*.

Fifth feet (fig. 18 *d*) with terminal seta about twice as long as the two-jointed foot, this seta reaches to the end of the third joint of the abdomen.

Male, length 4·1–4·2 mm., cephalothorax (fig. 18 *e*) two and a half times as long as the abdomen, rostrum as in the female, fifth thoracic segment rounded in lateral view, in dorsal view there is a deep groove visible between the fourth and fifth thoracic segments (fig. 18 *f*). Fifth feet of the type figured by Sars (1925) for *S. persecans* but with a longer endopodite on the right foot, and a well-marked transparent ridge on the second joint of the exopodite of the same foot.

Occurrence.—A few specimens in five surface hauls off New Zealand.

Remarks.—This species is most readily separated from others of the genus by the appearance of the last thoracic segment of the female in dorsal view. In this character it approaches *S. Thomasi* described by A. Scott (1909), but differs markedly from that species in other respects, in particular in the form of the rostrum and of the fifth feet. The male described above was found in company with the female on two stations.

Records.—**30°–40°** S.: 92 (*2*), 100 (*2*), 106 (*1*), 129 (*5*), 130 (*2*).

96. *Amallophora altera*, n. sp. Fig. 19.

Description.—Female, length 2·67–2·76 mm., cephalothorax (fig. 19 *a*, *b*) 2·16 mm., abdomen 0·51 mm. Cephalothorax an elongate oval in dorsal view, contracted posteriorly, cephalon fused with first thoracic segment, fourth and fifth thoracic segments separated, the fifth produced laterally into rounded lobes.

Genital segment (fig. 19 *c*, *d*) scarcely swollen ventrally, equal in length to the three following segments and about $1\frac{1}{4}$ times as long as wide.

Antennules barely reaching to the fifth thoracic segment, length of joints of antennule in 0·01 mm:

1	2	3	4	5	6	7	8–9	10	11	12	13
15·0	12·0	6·0	6·0	6·6	7·2	6·6	11·4	4·8	4·8	6·0	8·8

14	15	16	17	18	19	20	21	22	23	24–25
8·8	10·8	10·8	10·8	9·0	9·0	10·5	11·0	10·5	13·5	18·0

large æsthetasks on 2nd, 14th, and 19th joints, two setæ on 12th, 14th, and 18th joints. Antennæ, mandibles and first and second maxillæ as in *A. typica*; the sheaf-like modified seta on the 2nd maxilla is not well preserved and appears as a rather shapeless granulated mass, there are also present about five other more slender transparent scoleciform setæ. Maxillipede (fig. 19 *e*) as in *A. typica* except that the setæ appear to be slightly stouter giving it a more setose appearance.

First foot (fig. 19 *f*) with three-jointed exopodite, the outer edge setæ being rather long and slender, those on the first and second joints reaching considerably beyond the ends of the following joints; the single-jointed endopodite does not show any lobe on its outer margin.

Second foot (fig. 19 *g*) with long, slightly curved seta on the first joint of the exopodite. The terminal spines of the 2nd to 4th feet are finely toothed, the teeth,

which number a little over fifty, being fused, except at their tips, so as to form a continuous lamina.

The 5th feet (fig. 19 *h*) are each composed of three sub-equal joints, the third joint being slightly longer and broader than the others and carrying two terminal spines

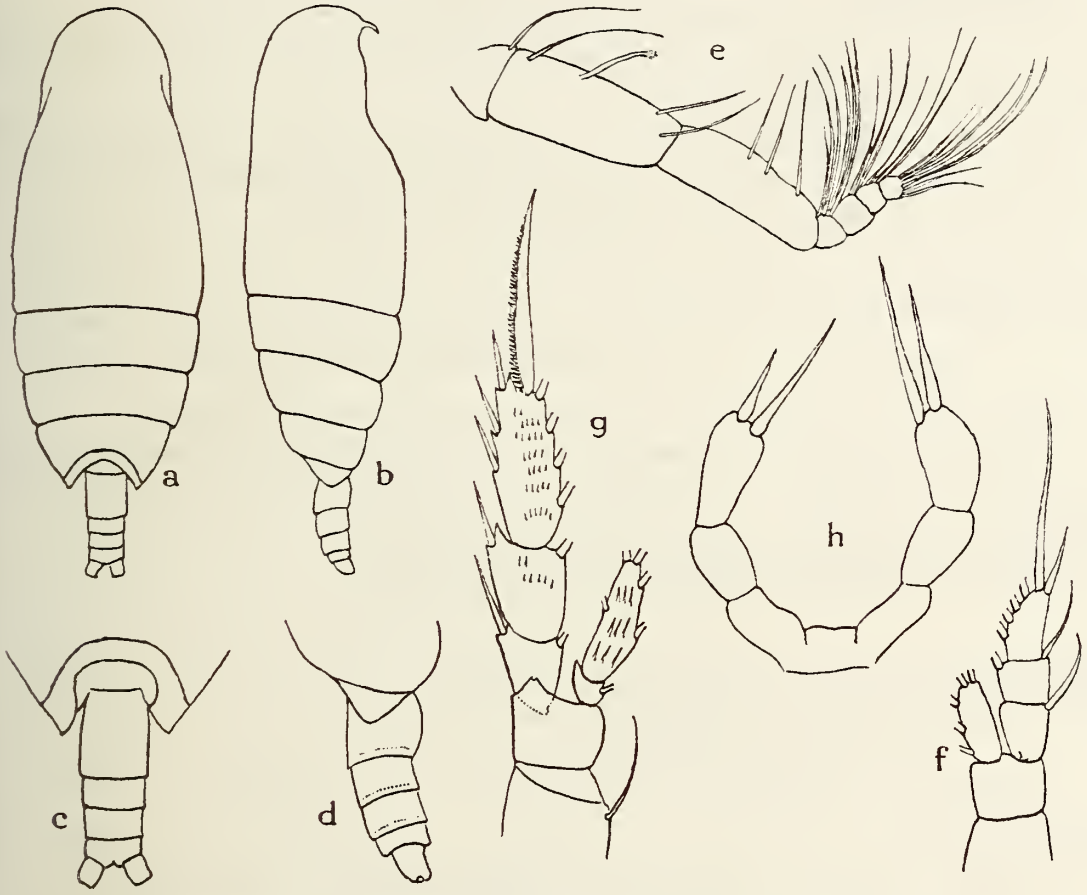

Fig. 19.—*Amallophora altera*, n. sp. Female: *a*, dorsal view, × 27; *b*, lateral view, × 27; *c*, abdomen, dorsal view; *d*, abdomen, lateral view; *e*, maxillipede, × 100; *f*, first foot, × 78; *g*, second foot, × 78; *h*, fifth feet, × 194.

a little longer than the joint, the outer spine slightly thicker but not so long as the inner.

Occurrence.—Two females in two vertical hauls from 1000 and 1750 metres in the Antarctic.

Remarks.—This species seems to be an undoubted *Amallophora*. In most of its characters it agrees closely with the type of the genus *A. typica*, the principal differences being the smaller size, the more produced lobes of the last thoracic segment, the absence of a lobe on the endopodite of the 1st foot and the form of the fifth feet, in which the basal joint is only as wide as the second and not quite so wide as the third joint, instead of being much wider than either as in *A. typica*. The characteristic modified seta of

the second maxilla could not be clearly made out, possibly on account of imperfect preservation, but it appeared to be of the same type as in *A. typica*.

Records.—**66° 30′–76°** S.: 276 (*1*), 282 (*1*).

97. *Lophothrix*, sp.

Occurrence.—No adult specimen was found but immature specimens, stages IV and V, were taken on two stations, off New Zealand at the surface, and in the Antarctic in a vertical haul 0–1000 metres.

Remarks.—The specimens from both localities were without a crest. As they were all in a poor state of preservation it was useless to attempt to identify them further.

Records.—**30°–40°** S.: 100 (*2*).—**66° 30′–76°** S.: 282 (*3*).

98. *Lophothrix latipes* (T. Scott).

Lophothrix latipes, G. O. Sars, 1925; *Scolecithrix acuta*, Farran, 1926.

Occurrence.—On four stations off New Zealand, surface to 30 fathoms.

Remarks.—Length, ♀, 2·8–3·0 mm. I have followed Sars in placing this species in the Genus *Lophothrix*. The segmentation between the second and third joints of the 5th foot of the female is not very distinctly marked.

Records.—**30°–40°** S.: 85 (*1*), 87 (*1*), 118 (*1*), 139 (*1*).

99. *Cephalophanes frigidus*, Wolfenden. Fig. 20.

Cephalophanes frigidus, Steuer, 1926.

Occurrence.—Two specimens, ♀ and stage IV, in the Antarctic in a vertical haul, 1000–0 metres.

Remarks.—Length, ♀, 4·32 mm., cephalothorax 3·48 mm., abdomen 0·84 mm. Abdominal segments and furca in 0·01 mm. 34, 19, 18, 2, 12. Fifth thoracic segments produced on either side of the genital segment and ending in a very small projection. Fifth feet (fig. 20) with the general form and spinulation of *C. frigidus* but with an inner edge spine on the third joint and thus resembling those of *C. refulgens*. The presence of this intermediate form of female in an area where *C. frigidus* might be expected to occur throws a good deal of doubt on the specific distinctness of *C. refulgens* and *C. frigidus*, and were it not that Steuer has described two distinct types of male, apparently corresponding to these two forms, I should have been inclined to unite them.

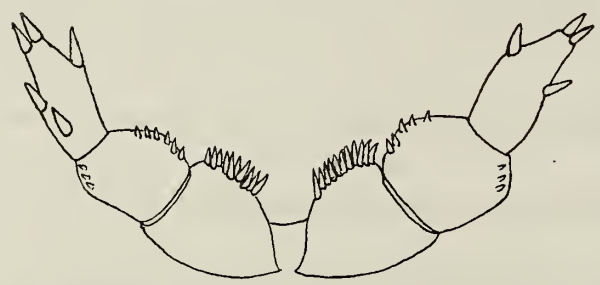

Fig. 20.—*Cephalophanes frigidus*. Female, fifth feet.

Record.—**66° 30′–76°** S.: 282 (*2*).

100. *Xanthocalanus*, spp.

No adults were found but a few immature specimens were taken in deep-water vertical hauls in the Antarctic. On station 282, 1000–0 metres, there were two in stage V measuring 3·96 and 5·04 mm., and three in stage IV measuring 3·84 mm., and on station 285, 600–0 metres, there was one in stage IV measuring 4·32 mm. Without some knowledge of the adults which occur in this area it would be unprofitable to try to identify them.

101. *Phœnna spinifera*, Claus.

Phœnna spinifera, Giesbrecht, 1892.

Occurrence.—On three stations off New Zealand, surface and 20 metres.

Remarks.—Length, ♀, 2·23 mm., ♂, 2·10 mm., stage V 1·8 mm. There was no dorsal protuberance on the cephalon of either male or female.

Records.—**30°–40°** S. : 75 (*1**), 93 (*1*), 133 (*1*).

102. *Centropages violaceus* (Claus).

Centropages violaceus, Giesbrecht, 1892.

Occurrence.—Taken in small or moderate numbers in the Atlantic from the Azores to 35° S. and on the most northerly (32° 55′ S.) of the New Zealand Stations.

Remarks.—Length, ♀, 1·88–2·04 mm., ♂, 1·92 mm.

Records.—North Temperate Atlantic : 66 (*3*), 67 (*2*), 68 (*1*), 70 (*4*).—Tropical Atlantic : 23 (*1*), *43* (*8*), 50 (*54*), 52 (*3*), 56 (*1*), 57 (*2*), 58 (*1*), 59 (*3*), 61 (*150*), 62 (*180*), 65 (*24*).—South Temperate Atlantic : 311 (*1*).—**30°–40°** S. : 114 (*1*).

103. *Centropages furcatus* (Dana).

Centropages furcatus, Giesbrecht, 1892.

Occurrence.—This typically tropical species was taken on two stations off Rio de Janeiro in large numbers, and on one other station in 4° S., one specimen.

Records.—Tropical Atlantic : 39 (*820*), 40 (*525*), 56 (*1*).

104. *Centropages Bradyi*, Wheeler.

Centropages Bradyi, Wheeler, 1901 ; *Centropages violaceus*, Brady, 1883 (Pl. XXVII).

Occurrence.—On several stations off New Zealand, from 32° 55′ S. to 52° S., usually singly and often immature. Wheeler's specimens were taken in the Gulf Stream off the east coast of the United States, 70 miles south of Martha's Vineyard.

Remarks.—Length, ♀, 1·68–2·07 mm., ♂, 2·1 mm. Wheeler has given the name *C. Bradyi* to the species with a very large furca which Brady had figured under the name of *C. violaceus* in the "Challenger" Report. It seems likely, however, that most of

Brady's records of *C. violaceus*, in spite of his erroneous figures, are correct. The size of Wheeler's specimens is not stated.

Records.—**30°–40°** S.: 83 (*1*), 86 (*1*), 106 (*1*), 114 (*1*), 120 (*1*), 132 (*1*), 137 (*2*).

105. *Centropages aucklandicus*, Krämer. Fig. 21.

Centropages typicus var. *aucklandicus*, Krämer, 1892; *Centropages aucklandicus*, Giesbrecht and Schmeil, 1898; *Centropages discaudatus*, Brady, 1899.

Occurrence.—On four stations off North and South Islands, New Zealand, including two in the Bay of Islands. Krämer's specimens were found in the Hauraki Gulf.

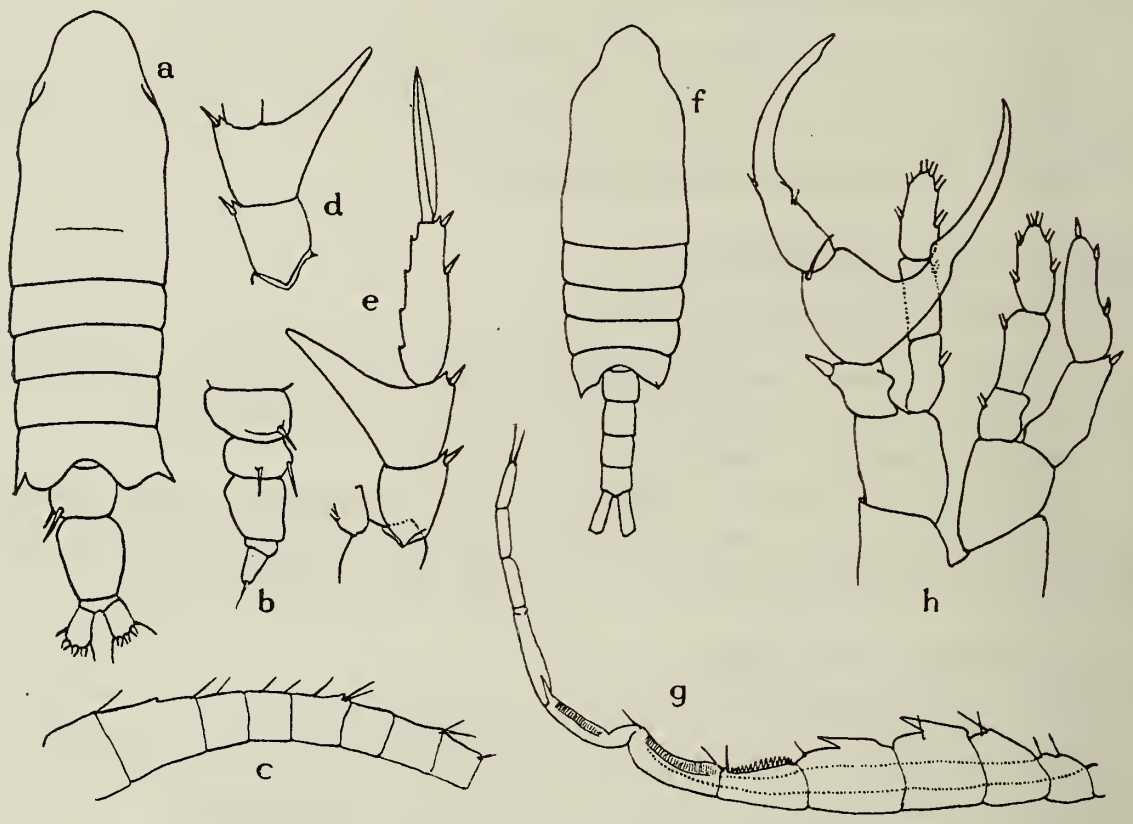

Fig. 21.—*Centropages aucklandicus*. Female: *a*, dorsal view, × 52; *b*, abdomen, lateral view, × 52; *c*, antennule, proximal joints, × 156; *d*, left fifth foot, × 174; *e*, right fifth foot, × 174. Male: *f*, dorsal view, × 47; *g*, right antennule, clasping joints, × 104; *h*, fifth feet, × 174.

Remarks.—Length, ♀, 1·54–1·71 mm., ♂, 1·44 mm. The abdomen of the female (fig. 21 *b*) is contained $2\frac{2}{3}$ times in the length of the cephalothorax. The last segment of the thorax is produced laterally into sharp points, that on the right divergent, that on the left directed straight backwards.

Abdominal segments and furca in the proportion 4, 6, 1, 3, as figured by Krämer, who does not mention or figure the dorso-lateral and lateral spines which are present on the left side of the genital segment. He regards the species, however, as a variety of *C. typicus*, in which these spines are conspicuous, and thus by implication suggests

their presence. Second abdominal segment in dorsal view wider anteriorly than the genital segment but narrowing gradually to the anal segment.

The antennules of the female (fig. 21 *c*) and male have very minute spines on the 1st, 2nd, and 5th joints. The male has well-marked spines on the 15th and 16th joints of the right grasping antennule (fig. 21 *g*). Fifth feet (fig. 21 *d*, *e*) of the female are almost symmetrical, a broad triangular expansion of the second joint of the exopodite being present on both sides.

Fifth feet (fig. 21 *h*) of the male of the same type as in *C. typicus* but with a much more slender chela on the right foot. Krämer's figure of the chela is wrongly proportioned and has probably been drawn as foreshortened.

Centropages discaudatus, described by Brady (1899) from Port Chalmers and Otago Harbour, is evidently, as he himself suggests, the same as *C. aucklandicus*, though he only mentions one spine on the genital segment of the female.

Records.—**30°–40°** S.: 114 (*1*), 148 [b (*1*), c (*1*)].—**40°–50°** S.: 242 (*9*).

106. *Temoropia mayumbœnsis*, T. Scott. Fig. 22.

Temoropia mayumbœnsis, Farran, 1908.

Occurrence.—One female in a vertical haul, 0–120 metres, off New Zealand.

Remarks.—Length, ♀, 0·78 mm. I have given a reference above to the specimen figured from the west coast of Ireland rather than to T. Scott's original description (1893) as the 5th feet (fig. 22 *a*) of the specimen in the present collection approaches more nearly to it than to Scott's figure. Two errors in the former account may be pointed out. The size of the Irish specimens is given as 7·2–8·0 mm. instead of 0·72–0·80 mm. and the claw at the end of the exopodite of the 5th foot is shown as a separate spine, whereas in reality it is formed by a notch at the end of the joint, the apparent segmentation being accidental. A figure of the 5th feet of another Irish specimen is given here (fig. 22 *b*), as it is in some respects intermediate between the present specimen and Scott's figure, and on account of it I have preferred to retain T. Scott's original name rather than to accept A. Scott's view (1909), which at first sight appeared convincing, that the Irish form represented a separate species. The pressure of a cover glass may sometimes alter the appearance of a mounted appendage very much by flattening out the cylindrical joints and this appears to have been the case in the Irish specimen here figured.

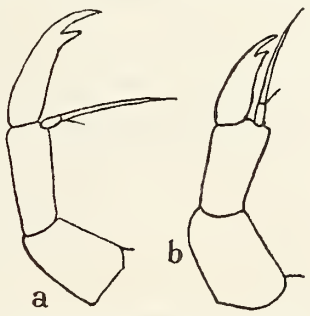

Fig. 22.—*Temoropia mayumbœnsis*. Female: *a*, fifth feet of New Zealand specimen; *b*, fifth feet of specimen from the West Coast of Ireland.

Record.—**30°–40°** S.: 74 (*1*).

107. *Temora stylifera* (Dana).

Temora stylifera Giesbrecht, 1892.

Occurrence.—Plentiful in the Tropical Atlantic.

Records.—27 (*1*), 39 (*900*), 40 (*1200*), 43 (*330*), 50 (*54*), 56 (*1*), 58 (*1*), 59 (*1*).

108. *Temora turbinata* (Dana).

Temora turbinata, Giesbrecht, 1892 ; *Temora tenuicauda*, Brady, 1899.

Occurrence.—In great abundance off North Island, New Zealand, sometimes constituting almost the entire gathering.

Remarks.—There seems to be no reason for separating *Temora tenuicauda*, described by Brady from New Zealand, from this species.

Records.—**30°–40°** S. : 71 (*78*), 72 (*11*), 73 (*12*), 74 (*4*), 75 (*77*), 76 (*68*), 77 (*121*), 79 (*275*), 81 (*6*), 82 (*2*), 83 (*110*), 84 (*4*), 85 (*1530*), 86 (*600*), 87 (*31*), 92 (*12*), 94 (*50*), 97 (*4*), 98 (*28*), 99 (*24*), 100 (*8100*), 101 (*63,000*), 103 (*84*), 104 (*288*), 105 (*206*), 106 (*55,300*), 107 (*15,000*), 108 (*32,500*), 109 (*184*), 110 (*20*), 112 (*6510*), 114 (*40*), 116 (*5*), 117 (*8*), 118 (*35,400*), 119 (*1670*), 120 (*7770*), 122 (*7*), 126 (*3*), 127 (*53,250*), 128 (*46,800*), 130 (*4*), 132 (*24,000*), 133 (*27*), 135 (*15*), 136 (*47*), 137 (*480*), 138 (*110*), 139 (*1*), 140 (*6800*), 146 (*6265*), 147 (*80*), 148 [a (*254*), b (*24*), c (*60*), e (*1*), f (*55*), i (*34*), j (*1*)], 161 (*1*), 202 (*2*), 203 (*2*).—**40°–50°** S. : 201 (*1*).—**50°–60°** S. : 238 (*1*), 250 (*1*).

109. *Metridia lucens*, Boeck.

Metridia lucens, G. O. Sars, 1903.

Occurrence.—South of New Zealand from 52° 11′ S. to within the Antarctic Circle, 71° 49′ S. Very abundant on a small group of stations off Lord Auckland Islands but scarce elsewhere.

Remarks.—Length, ♀, 2·5–2·96 mm., usually about 2·7 mm. A small amount of variation in the form of the fifth feet of the female occurs. Three terminal setæ of moderate size appear to be always present on the third joint, a very small seta is usually but not always present on the outer edge of the same joint and a small inner edge seta may sometimes be found. The third joint may be from half to two-thirds as long as the second.

Records.—**50°–60°** S. : 199 (*1**), 235 (*4150*), 236 (*32*), 237 (*1*), 238 (*740*), 240 (*1*), 241 (*2500*), 256 (*1**), 305 (*20**).—**60°–66° 30′** S. : 228 (*3*), 230 (*2*).—**66° 30′–76°** S. : 172 (*3*), 177 (*2**), 275 (*1**), 285 (*2**), 300 (*9*).

110. *Metridia princeps*, Giesbrecht.

Metridia princeps, G. O. Sars, 1925.

Occurrence.—One mature male and three immature specimens in a vertical haul from 1000 metres within the Antarctic.

Remarks.—Length, ♂, 8·5 mm.

Record.—**66° 30′–76°** S. : 282 (*4*).

111. *Metridia Gerlachei*, Giesbrecht.

Metridia Gerlachei, Giesbrecht, 1902.

Occurrence.—This typically Antarctic species was found mainly from the Antarctic Circle southwards and occurred very plentifully in the hauls made beneath the ice at winter quarters. The most northerly point at which live specimens were taken was 61° 18′ S., but a few dead specimens were found as far north as 52° 41′ S.

Records.—**50°–60°** S.: 210 (*1* dead), 235 (*3* dead).—**66°–66° 30′** S.: 228 (*70*), 229 (*1*), 230 (*60*), 300 (*10*).—**66° 30′–76°** S.: 172 (*7*), 177 (*27*), 178 (*77*), 180 (*300*), 224 (*62*), 267 (*108*), 269 (*3*), 270 (*240*), 271 (*4*), 272 (*60*), 274 (*28*), 275 (*1000*), 276 (*126*), 281 (*4170*), 282 (*360*), 284 (*156*), 285 (*312*), 288 (*24*), 289 (*9*), 293 (*5*).—**76°–78°** S.: 317 [4 (*1155*), 5 (*665*), 6 (*2070*), 7 (*6080*), 9 (*748*), 10 (*264*), 11 (*4100*), 15 (*3200*), 17 (*346*), 18 (*1400*), 19 (*500*), 21 (*1155*), 22 (*2055*), 23 (*490*), 24 (*2400*), 25 (*220*), 27 (*1*), 29 (*1350*), 30 (*940*), 31 (*430*), 37 (*190*), 38 (*940*)], 318 (abundant), 323 [39 (*380*), 41 (*610*), 43 (*107*), 44 (*289*), 48 (*8*)], 325 (*8*), 342 (*430*), 343 (*77*), 344 (*128*), 345 (*400*), 346 (*150*), 347 (*80*), 350 (*260*), 351 [57 (*30*), 58 (*506*), 59 (*405*), 60 (*1110*), 61 (*3300*), 62 (*5460*), 63 (*7700*), 64 (*7100*), 65 (*6480*)], 352 (*1210*), 354 (*11*), 357 (*7*).

112. *Metridia curticauda*, Giesbr.

Metridia curticauda, Giesbrecht, 1892.

Occurrence.—Numerous specimens in the Antarctic in vertical hauls from depths of 600 metres or more.

Remarks.—Length, ♀, 2·52–3·00 mm., ♂, 1·92–2·28 mm. This species has also been recorded by Wolfenden (1911) from the Antarctic, from deep water hauls made by the "Gauss."

Records.—**66° 30′–76°** S.: 270 (*11*), 276 (*60*), 282 (*300*), 285 (*9*).

113. *Pleuromamma abdominalis* (Linn.).

Pleuromma abdominale, Giesbrecht, 1892.

Occurrence.—Occurred in very varying numbers over all the region traversed except south of 60° S.

Remarks.—The females varied in size from 2·4 to 4·5 mm., the intermediate sizes from 2·75 to 3·3 mm. being the most frequent. Both large and small specimens were sometimes taken on the same station.

Records.—North Temperate Atlantic: 66 (*2*), 67 (*2*), 68 (*8*), 69 (*1*), 70 (*1*).—Tropical Atlantic: 56 (*1*), 57 (*20*), 58 (*3*), 59 (*70*), 64 (*6*), 65 (*4*).—**30°–40°** S.: 74 (*8*), 75 (*7*), 84 (*12*), 85 (*495*), 86 (*1000*), 87 (*41*), 89 (*207*), 92 (*1400*), 93 (*2000*), 97 (*2*), 100 (*14*), 101 (*1*), 106 (*10*), 107 (*265*), 109 (*550*), 110 (*1*), 120 (*770*), 122 (*1*), 126 (*2*), 127 (*6250*), 128 (*80*), 129 (*1600*), 130 (*226*), 131 (*11*), 132 (*10*), 133 (*7*), 136 (*2*), 138 (*1*), 139 (*300*).—**50°–60°** S.: 238 (*2*).

114. *Pleuromamma xiphias* (Giesbrecht).

Pleuromamma xiphias, G. O. Sars, 1925.

Occurrence.—Only taken off New Zealand, where it was scarce except in one surface gathering taken by night with a townet of very coarse mesh.

Remarks.—Length, ♀, 4·25–4·7 mm.

Records.—**30°–40°** S.: 86 (*2*), 89 (*4*), 92 (*5*), 100 (*1*), 107 (*1*), 127 (*13*), 129 (*650*), 130 (*39*).

115. *Pleuromamma robusta* (F. Dahl).

Pleuromamma robusta, G. O. Sars, 1903.

Occurrence.—Making allowance for the unsuitability of the nets used for its capture this species seemed to be common in a small area south of New Zealand between 51° and 53° S.

Remarks.—Length, ♀, 4·2–4·7 mm., ♂, 3·24 mm. These specimens appeared to be identical with the North Atlantic form.

Records.—**50°–60°** S.: 235 (*174*), 238 (*34*), 240 (*1*), 241 (*20*).

116. *Pleuromamma gracilis* (Claus). Figs. 23, 24.

Pleuromma gracilis, Giesbrecht, 1892.

Occurrence.—Of frequent occurrence in the North Temperate and Tropical Atlantic from 29° 10′ N. southwards. Common off New Zealand and sometimes abundant. Its range extended as far south as the Auckland and Campbell Islands.

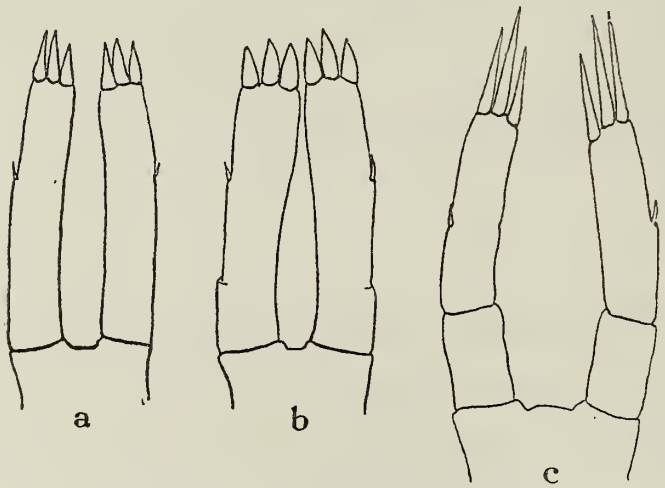

Fig. 23.—Fifth feet of females of (*a*) *Pleuromamma gracilis*, (*b*) *Pleuromamma Piseki*, n. sp., (*c*) *Pleuromamma borealis*, all × 233.

Remarks.—In his review of the Genus *Pleuromamma* as taken on the Plankton Expedition, Pisek (1923) has noted that *P. gracilis*, as distinct from *P. borealis*, falls into two groups which he terms the "typical" and "atypical" forms. The "atypical" form he distinguishes by its less pronounced genital boss, its slightly smaller size and its anal segment with diverging lateral margins and projecting postero-lateral angles as compared with the "typical" form in which the anal segment is parallel sided. The presence of these two forms was obvious in the "Terra Nova" collections. They were both found over most of the area traversed, usually occurring together in the same gathering sometimes one and sometimes the other

being the more numerous. On closer examination some fresh points of difference became apparent and it seems that, unless we assume that *P. gracilis* is a dimorphic species, the two forms should be regarded as specifically distinct. I have accordingly proposed below a new name, *P. Piseki*, for Pisek's " typical " form, as it is clear from Giesbrecht's (1892) description of *P. gracilis* from Naples that he had the " atypical " form, with diverging anal segment, before him and probably so also had Claus (1863), though his original description is not conclusive.

Steuer (1925) recognises these two forms, his " Mittelrasse " (2·06–2·28 mm.) corresponding in the form of the anal segment to Pisek's typical form and his " Zwergrasse " (1·95–2·05 mm.) to the atypical form. He also adds another distinguishing character to the typical form, its darkly pigmented genital pore, and relying on size divides the atypical form into a " Zwerg—" and a " Riesenrasse." He points out differences in the fifth feet of the males corresponding to the typical and atypical females which I have not attempted to verify.

Females from the North Temperate Atlantic measured 1·85 mm., from the Tropical Atlantic 1·7–1·83 mm., from off New Zealand in 30°–40° S., 1·8–1·98 mm., and from off the Auckland and Campbell Islands 2·28–2·4 mm. The fifth feet (fig. 23 *a*) of the female consist of two fused parallel-sided joints, sometimes with segmentation indicated but usually joined without any sign of segmentation. The joints are of uniform thickness, about five and a half times as long as wide, with three sub-equal terminal spines, the central spine about as long or very slightly longer than the width of the joint.

Records.—North Temp. Atlantic : 66 (*7*), 67 (*9*), 69 (*1*).—Tropical Atlantic : 43 (*1*), 50 (*75*), 58 (*31*), 59 (*91*), 64 (*90*).—**30°–40°** S. : 81 (*2*), 83 (*1*), 84 (*95*), 85 (*990*), 86 (*3170*), 87 (*35*), 97 (*17*), 107 (*456*), 109 (*1*), 120 (*210*), 122 (*3*), 127 (*1800*), 128 (*440*), 132 (*10*), 138 (*2*), 139 (*1*).—**50°–60°** S. : 235 (*60*), 238 (*? 1*), 241 (5).

117. *Pleuromamma Piseki*, n. sp. Figs. 23, 24.

Pleuromamma gracilis, pars, Pisek, 1923.

Occurrence.—Of frequent occurrence in the North Temperate and Tropical Atlantic from 29° 10′ N. southwards. Common off New Zealand and sometimes abundant.

Remarks.—I propose the above name for the species which Pisek (1923) designated as the typical form of *P. gracilis*, distinguishing it from the atypical form which in my opinion is the true *P. gracilis* of Claus.

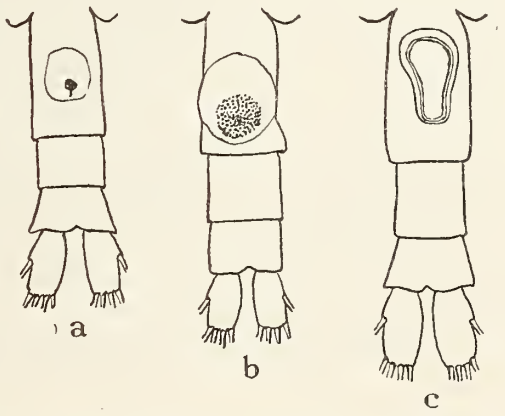

Fig. 24.—Abdomen, ventral view, of (*a*) *Pleuromamma gracilis*, (*b*) *Pleuromamma Piseki*, n. sp., (*c*) *Pleuromamma borealis*, all × 62.

The female of *P. Piseki* can be distinguished from *P. gracilis* by its slightly larger average size, 1·95–2·0 mm., its genital segment (fig. 24 *b*), which has a marked groove

or constriction on the left side parallel to and close to the posterior margin of the segment and a large black pigmented area round the genital pore, its anal segment (fig. 23 *b*), with parallel lateral margins and its fifth feet, which are imperfectly jointed, four and a half to five times as long as wide, and terminating in three short stout spines, shorter than the width of the joint. Although the average size was smaller, the smallest observed size, 1·7 mm. in the Tropical Atlantic, was the same as that of *P. gracilis*. The range of the two species was the same, except that *P. Piseki* was not found between 50° and 60° S., and they usually occurred together in the same gatherings.

Records.—North Temp. Atlantic: 67 (*6*), 68 (*24*).—Tropical Atlantic: 39 (*2*), 50 (*3*), 51 (*2*), 59 (*21*), 64 (*90*), 65 (*90*).—**30°–40°** S.: 75 (*3*), 76 (*2*), 81 (*2*), 84 (*280*), 85 (*2070*), 86 (*9510*), 87 (*57*), 89 (*5*), 92 (*7*), 97 (*14*), 100 (*2*), 106 (*280*), 107 (*178*), 109 (*14*), 120 (*630*), 127 (*7200*), 128 (*1000*), 133 (*7*), 135 (*3*), 138 (*2*).

118. *Pleuromamma borealis* (Dahl). Figs. 23, 24.

Pleuromamma borealis, Pisek, 1923; *Pleuromamma gracilis* var *Esterleyi*, T. Scott, 1912.

Occurrence.—On two, or possibly three, stations off the Auckland and Campbell Islands, surface to 30 metres, in moderate numbers. It is not improbable that occasional specimens may have been overlooked in other localities.

Remarks.—Length, ♀, 2·28–2·34 mm. The recognition of *P. borealis* from the short description given by Dahl is a matter of some difficulty and most investigators have apparently failed to recognise it. Pisek, however, on the authority of Prof. Steuer has added the additional information that the genital boss is flattened in lateral view and that the 5th feet (fig. 23 *c*) of the female have three long terminal spines as compared with the three short ones of *P. gracilis*, and Steuer himself (1925) adds that it is identical with *P. gracilis* var *Esterleyi* of Scott (1912). With this new information available I am able to say that most if not all of the specimens which I have recorded as *P. gracilis* from the west coast of Ireland (1908) and from the Bay of Biscay (1926) are in reality *P. borealis*.

As an additional distinction it may be mentioned that the spermatheca in *P. borealis* (fig. 24 *c*) is of an inverted pear shape, in *P. gracilis* it is more like a cherry.

The specimens of *Pleuromamma* from Station 238 were mixed with those from 235 before the occurrence of *P. borealis* was noticed, consequently the record from that station is doubtful though probable.

Records.—**50°–60°** S.: 235 (*60*), 238 (*? 1*), 241 (*5*).

119. *Lucicutia flavicornis* (Claus).

Leuckartia flavicornis, Giesbrecht, 1892.

Occurrence.—Frequent throughout the Atlantic and off New Zealand.

Remarks.—Length, ♀, usually 1·4–1·5 mm. Occasional large females, up to

1·96 mm., and males, up to 1·8 mm., were found. All the females which were examined microscopically were characterised by the serration of the outer edge of the 3rd joint of the exopodite of the 5th feet, as figured by Giesbrecht (1892) in pl. XIX, fig. 15.

Records.—North Temperate Atlantic : 66 (*200*), 67 (*64*), 68 (*160*), 70 (*1*).—Tropical Atlantic : 64 (*31*), 65 (*60*).—**30°–40°** S. : 74 (*2*), 75 (*36*), 76 (*10*), 77 (*2*), 83 (*24*), 84 (*105*), 85 (*450*), 86 (*3320*), 87 (*39*), 89 (*1*), 92 (*2*), 93 (*2*), 97 (*10*), 100 (*12*), 107 (*106*), 114 (*2*), 117 (*3*), 118 (*1*), 120 (*770*), 122 (*1*), 127 (*14,250*), 128 (*40*), 132 (*40*), 139 (*1*).

120. *Lucicutia gemina*, Farran.

Lucicutia gemina, **Farran**, 1926.

Occurrence.—Off New Zealand, very scarce.

Remarks.—Length, ♀, 1·60–1·78. Only two specimens, females, were found, but it is not improbable that others were overlooked amongst the numerous *L. flavicornis*, which it closely resembles.

Records.—**30°–40°** S. : 97 (*1*), 100 (*1*).

121. *Lucicutia Clausi* (Giesbr.).

Leuckartia Clausi, Giesbrecht, 1892.

Occurrence.—In two surface hauls off New Zealand.

Remarks.—Length, ♀, 1·8 mm., ♂, 1·7–1·8 mm. Both males and females in all cases had lateral hooks on the cephalon.

Records.—**30°–40°** S. : 79 (*1*), 100 (*9*).

122. *Lucicutia ovalis*, Wolfenden. Fig. 25.

Lucicutia ovalis, Wolfenden, 1911.

Occurrence.—Found on two stations in the Atlantic in 25° 35′ N., and in moderate numbers off New Zealand.

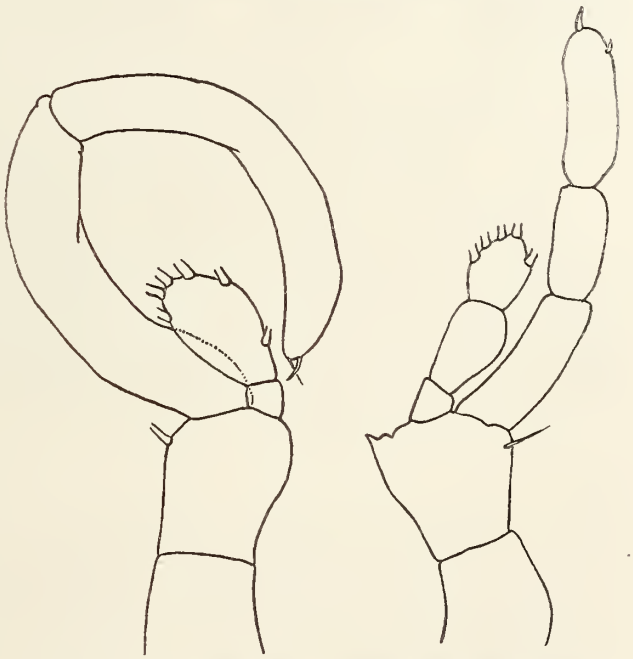

Fig. 25.—*Lucicutia ovalis*. Male, fifth feet, × 234.

Remarks. — Length, ♀, 1·38–1·56 mm., ♂, 1·32–1·38 mm. This species can be distinguished by its small size, short squat form and two-jointed endopodite of the 1st pair of feet. The terminal spine of the exopodite of the 5th feet of the female is very short. The male, which has not yet been described, resembles the female in the form of the cephalothorax and

appendages except the 5th feet (fig. 25) which have a very small right endopodite The notch which Wolfenden figures on the outer edge of the third joint of the exopodite of the 4th foot was not found in either sex. Evidently it is not a specific character.

Records.—North Temperate Atlantic: 66 (6), 67 (9).—**30°–40°** S.: 75 (*4*), 81 (*5*), 85 (*4*), 87 (*8*), 94 (*2*), 100 (*14*).

123. *Lucicutia curta*, Farran.

Lucicutia curta, Farran, 1905.

Occurrence.—Several specimens in a vertical haul from 1000 metres in the Antarctic. It was originally described from a similar depth off the West Coast of Ireland.

Remarks.—Length, ♀, 2·4–2·52 mm., ♂, 2·15–2·3 mm.

Record.—**66° 30′–76°** S.: 282 (*33*).

124. *Lucicutia magna*, Wolfenden.

Lucicutia magna, Wolfenden, 1903; *Lucicutia atlantica*, G. O. Sars, 1925.

Occurrence.—Taken in the Antarctic in two vertical hauls from 1000 and 600 metres, immature specimens only in the latter haul.

Remarks.—Length, ♀, 3·9 mm. Wolfenden (1911) has already recorded it from the Antarctic in 2000–3000 metres.

Records.—**66° 30′–76°** S.: 282 (*8*), 285 (*2**).

125. *Lucicutia grandis* (Giesbr.).

Lucicutia grandis, Wolfenden, 1911; *Lucicutia grandis*, G. O. Sars, 1925.

Occurrence.—Seven specimens in the Antarctic in a vertical haul from 1000 metres.

Remarks.—Length, ♀, 6·84 mm. The three females were without cephalic spines or hooks, but the immature specimens, one in stage V and three in stage IV, had short stout medio-lateral spines one on each side of the cephalon. Giesbrecht's (1924) figure of the female of this species does not show the characteristic form of the genital pad, but it is well figured by Wolfenden (1911).

Record.—**66° 30′–76°** S.: 282 (*7*).

126. *Heterorhabdus spinifrons* (Claus).

Heterorhabdus spinifrons, G. O. Sars, 1925.

Occurrence.—Four specimens were taken in three hauls off New Zealand, surface, 0–2 metres and 0–100 metres.

Remarks.—Length, ♀, 3·6 mm. This species seems to have a world-wide tropical and temperate distribution.

Records.—**30°–40°** S.: 80 (*1*), 84 (*2*), 106 (*1*).

127. *Heterorhabdus papilliger* (Claus).

Heterorhabdus papilliger, G. O. Sars, 1925.

Occurrence.—The most frequent species of *Heterorhabdus* in the collection, both in the Atlantic and especially off New Zealand, usually occurring at or near the surface in small numbers.

Remarks.—Length, ♀, 1·85 mm.

Records.—North Temp. Atlantic: 67 (*1*), 68 (*8*).—Trop. Atlantic: 50 (*1*), 58 (*1*), 59 (*1*).—**30°–40°** S.: 75 (*7*), 76 (*1*), 80 (*1*), 81 (*1*), 83 (*1*), 84 (*3*), 85 (*4*), 86 (*80*), 87 (*51*), 89 (*3*), 92 (*11*), 93 (*30*), 97 (*1*), 100 (*31*), 106 (*1*), 107 (*1*), 117 (*1*), 120 (*7*), 137 (*1*).

128. *Heterorhabdus austrinus*, Giesbr. Fig. 26.

Heterorhabdus austrinus, Giesbrecht, 1902.

Occurrence.—Found only in the Antarctic, in small numbers both in the epiplankton and deep hauls. Not taken south of 72° S.

Remarks.—Length, ♀, 3·42–3·85 mm., ♂, 3·48–3·60 mm. The females scarcely differ except in their slightly larger size from the North Atlantic species which I have referred (1908, 1926) to *H. norvegicus*, but the more slender inner edge spine on the second joint of the exopodite of the 5th foot in *H. austrinus* seems in most cases to be a diagnostic character. The male of *H. austrinus* does not seem to have been described, as Wolfenden's record with description of a supposed male evidently refers to a species in the *vipera* section of the genus, probably to *H. robustus*. Several males were found in the "Terra Nova" collection. They do not differ in any noticeable degree from those of *H. norvegicus*, but the 5th pair of feet (fig. 26) show some small distinctions.

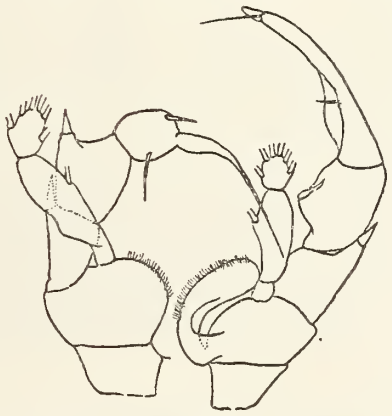

Fig. 26.—*Heterorhabdus austrinus*. Male, fifth feet, × 86.

Records.—**66° 30′–76°** S.: 178 (*2*), 180 (*2*), 269 (*1*), 270 (*20*), 272 (*1*), 275 (*1*), 276 (*9*), 282 (*20*), 285 (*25*), 288 (*1*).

128*a*. *Heterorhabdus austrinus*, var.

Remarks.—What appears to be a small form of *H. austrinus*, ♀, 2·97–3·18 mm. and ♂, 2·84–2·88 mm., occurred on several stations between 40° S. and the Antarctic Circle and on two stations in the Antarctic. There seems to be no specific distinction except size, and probably intermediate sizes will be found, but in the meantime it seems best to record them separately.

Records.—**40°–50°** S.: 242 (*1*).—**50°–60°** S.: 235 (*6*), 236 (*1*), 238 (*18*), 241 (*240*), 305 (*1*).—**60°–66° 30′** S.: 300 (*2*).—**66° 30′–76°** S.: 172 (*8*), 269 (*1*).

129. *Heterorhabdus pustulifer*, n. sp. Fig. 27.

Description.—Female, length 2·98–3·04 mm. Cephalothorax (fig. 27 *a*) moderately slender, as in *H. norvegicus* and *H. abyssalis*. Abdomen contained about 1½ times in length of cephalothorax proportional length of segments, including furca 27, 10, 8, 5, 15. Genital segment barrel-shaped in dorsal view (fig. 27 *b*), slightly more bulging on the left side; in lateral view (fig. 27 *c*) the genital boss is well developed, the anterior flap being sometimes depressed and sometimes standing outwards, and in the centre of the dorsal surface there is a small but well-marked projection or papilla. Posterior margins of the abdominal segments spinose. Furca of the same type as in *H. norvegicus*, with the left ramus imperfectly separated from the anal segment.

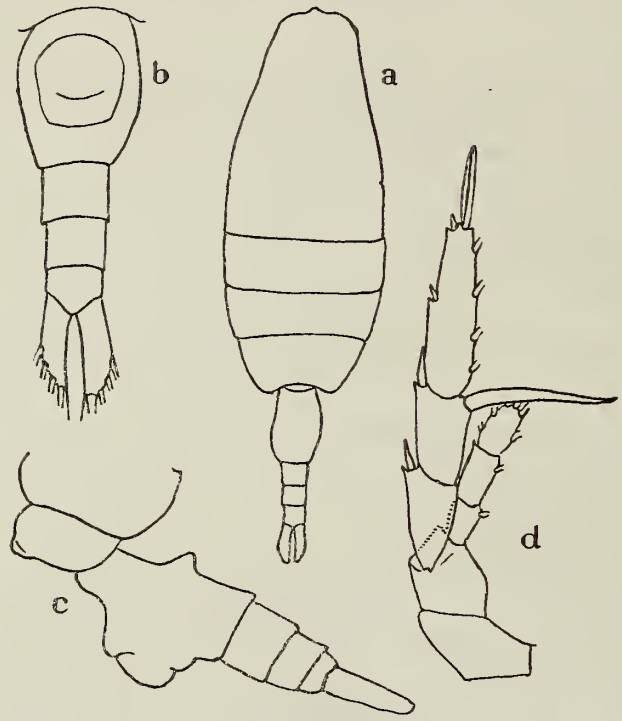

Fig. 27.—*Heterorhabdus pustulifer*, n. sp. Female: *a*, dorsal view, × 24; *b*, abdomen, ventral view, × 44; *c*, abdomen, lateral view, × 44; *d*, fifth foot, × 95.

The cephalic and thoracic appendages are in general similar to those of *H. norvegicus* and *H. austrinus*, but the 5th feet (fig. 26 *d*) have the inner edge spine of the second joint of the exopodite equal in length to the third joint instead of distinctly shorter.

No male belonging to this species was identified.

Occurrence.—A few females in two vertical hauls, from 600 and 1000 metres, in the Antarctic.

Remarks.—Except for the dorsal papilla on the genital segment the female of this species is scarcely to be distinguished from the three closely allied species *H. norvegicus*, *H. abyssalis*, and *H. austrinus*.

Records.—**66° 30′–76°** S.: 282 (*7*), 285 (*1*).

130. *Heterorhabdus robustus*, Farran.

Heterorhabdus robustus, Farran, 1908; *Heterorhabdus robustus*, G. O. Sars, 1925; *Alloiorhabdus austrinus*, Wolfenden, 1911.

Occurrence.—Frequent in the Antarctic in vertical hauls from depths below 500 metres.

Remarks.—Length, ♀, 3·65 mm. It is evident from Wolfenden's description and figures of the Antarctic specimens which he referred to *Alloiorhabdus austrinus* that it was *H. robustus* that he had before him. This species belongs to the *vipera* group of

Heterorhabdus and is distinguishable by its comparatively long furca which, measured on the inside, is contained $3\frac{1}{2}$ times in the total length of the abdomen. It is a characteristic deep-water species in the North Atlantic.

Records.—66° 30′–76° S. : 177 (*2*), 178 (*6*), 270 (*11*), 276 (*15*), 282 (*48*).

131. *Heterorhabdus compactus*, G. O. Sars.

Heterorhabdus compactus, G. O. Sars, 1925.

Occurrence.—In two vertical hauls in the Antarctic, from 1750 and 1000 metres ; all the specimens in the latter haul were immature.

Remarks.—Length, ♀, 3·2 mm., ♂, 2·88 mm. This species has the stout form of *H. robustus*, but it can be distinguished by its very short furca. Sars has recorded this species with a range of size of from 3·35 mm. in the Arctic (1900) to 2·3 mm. in the North Atlantic (1925). If this is correct it is probable that *H. compactus* and the imperfectly described *H. brevicornis* of F. Dahl (1894) are identical.

Records.—66° 30′–76° S. : 276 (*2*), 282 (*4**).

132. *Heterostylites major* (Dahl).

Heterostylites major, G. O. Sars, 1925 ; *Alloiorhabdus medius*, Wolfenden, 1911.

Occurrence.—In the Antarctic in a vertical haul from 1750 metres, two specimens, a male and a female.

Remarks.—Length, ♀, 4·92 mm., ♂, 4·26 mm. This species has already been recorded from the Antarctic, under the new name of *Alloiorhabdus medius*, by Wolfenden, who founded both species and genus under a misapprehension as to the number of setæ on the endopodites of the swimming feet in the Genus *Heterorhabdus*. The male shows the usual sexual differences from the female. The fifth feet are of the same type as those of *H. longicornis*.

Record.—66° 30′–76° S. : 276 (*2*).

133. *Heterostylites longicornis* (Giesbr.).

Heterostylites longicornis, G. O. Sars, 1925.

Occurrence.—One specimen, stage IV, length 1·32 mm., with very long antennæ, was taken in a surface haul in the Atlantic in 22° 6′ S. *H. longicornis*, which has already been recorded from the Tropical Atlantic, is the only described species to which the specimen can be referred.

Record.—Tropical Atlantic : 43 (*1**).

134. *Haloptilus acutifrons* (Giesbr.).

Hemicalanus acutifrons, Giesbrecht, 1892.

Occurrence.—Taken once in the North Atlantic. Frequent off New Zealand.

Remarks.—Length, ♀, 3·5–3·9 mm. The New Zealand specimens are larger than those recorded from the North Atlantic, which measured 3·2–3·5 mm. (Sars, 1925, Farran, 1926), and the latter are larger than Giesbrecht's original records, 2·6–2·9 mm., from the Mediterranean.

Records.—North Temperate Atlantic: 70 (*1*).—**30°–40°** S.: 75 (*4*), 80 (*4*), 83 (*1*), 85 (*2*), 86 (*1*), 87 (*1*), 93 (*2*), 100 (*3*), 112 (*1*), 126 (*2*).

135. *Haloptilus oxycephalus* (Giesbr.).

Haloptilus oxycephalus, G. O. Sars, 1925.

Occurrence.—Found on both sides of the Antarctic Circle, between 50° and 78° S., in horizontal hauls at moderate depths and in vertical hauls from deep water.

Remarks.—Length, ♀, 4·02–4·08 mm. Its larger size and longer cephalic spine distinguish it readily from *H. acutifrons*.

Records.—**50°–60°** S.: 238 (*1*), 250 (*1*).—**60°–66° 30′** S.: 300 (*3*).—**66° 30′–76°** S.: 172 (*1**), 178 (*6*), 180 (*1*), 240 (*4*), 272 (*1**), 275 (ca. *200*), 276 (*2*).—**76°–78°** S.: 342 (*1**).

136. *Haloptilus ocellatus*, Wolfenden.

Haloptilus ocellatus, Wolfenden, 1911.

Occurrence.—Found only in the Antarctic, but not south of 76° S., and taken both at moderate depths, 60–100 metres, and in vertical hauls from deep water. Probably the specimens in vertical hauls from great depths were caught in the upper waters.

Remarks.—Length, ♀, 8·2–8·5 mm. The brown spot on the dorsal surface of the cephalothorax is found both in the adults and in the young stages.

Records.—**66° 30′–76°** S.: 178 (*14*), 180 (*12*), 270 (*16*), 272 (*5*), 275 (*270*), 276 (*1*), 281 (*1*), 282 (*9*), 284 (*12*), 287 (*27*), 288 (*2*).

137. *Haloptilus spiniceps* (Giesbrecht).

Hemicalanus spiniceps, Giesbrecht, 1892.

Occurrence.—One immature specimen in the North Atlantic, off the Azores, and a few, both females and immature, off New Zealand.

Remarks.—Length, ♀, 4·56 (New Zealand), stage V, 3·22 (N. Atlantic). The ovaries are produced into the anterior part of the cephalon as a thin line on each side.

Records.—North Temp. Atlantic: 70 (*1**).—**30°–40°** S.: 85 (*1*), 93 (*5*), 100 (*1*), 130 (*1*), 131 (*2*).

138. *Haloptilus mucronatus* (Claus).

Haloptilus mucronatus, G. O. Sars, 1925.

Occurrence.—Scarce off New Zealand.

Remarks.—Length, ♀, 3·15–3·36 mm. The ovaries are well developed in the anterior part of the cephalon, giving it an opaque and distinctive appearance.

Records.—**30°–40°** S.: 80 (*1*), 85 (*3*), 86 (*1*), 106 (*1*).

139. *Haloptilus longicornis* (Claus).

Haloptilus longicornis, G. O. Sars, 1903.

Occurrence.—This widespread species was only found on a few stations off New Zealand.

Remarks.—Length, ♀, 2·04–2·16 mm.

Records.—**30°–40°** S. : 75 (*1*), 80 (*2*), 86 (*1*), 87 (*3*), 92 (*1*), 93 (*1*), 100 (*4*).

140. *Augaptilus longicaudatus* (Claus).

Augaptilus longicaudatus, Giesbrecht, 1892.

Occurrence.—Taken off New Zealand in two townettings, a vertical haul, 0–100 metres, and a surface haul by night.

Remarks.—Length, ♀, 2·04–2·16 mm.

Records.—**30°–40°** S. : 80 (*5*), 127 (*2*).

141. *Euaugaptilus hecticus* (Giesbr.).

Augaptilus hecticus, Giesbrecht, 1892.

Occurrence.—One specimen, a male, length 2·28 mm. in a haul at 30 metres off New Zealand.

Record.—**30°–40°** S. : 87 (*1*).

142. *Euaugaptilus filigerus* (Claus).

Augaptilus filigerus, Giesbrecht, 1892.

Occurrence.—One specimen, a female, length 5·75 mm. in a vertical haul 0–100 metres off New Zealand.

Record.—**30°–40°** S. : 80 (*1*).

143. *Euaugaptilus laticeps* (G. O. Sars).

Euaugaptilus laticeps, G. O. Sars, 1925 ; *Augaptilus antarcticus*, Wolfenden, 1911.

Occurrence.—In vertical hauls from 1000 and 1750 metres in the Antarctic.

Remarks.—Length, ♀, 9·4–10·0 mm., ♂, 8·3 mm. In the Atlantic as in the Antarctic this is exclusively a deep-water species. There can be little doubt that *Augaptilus antarcticus*, which Wolfenden (1911) has described from similar depths in the Antarctic, is the same as *E. laticeps*.

Records.—**66° 30′–76°** S. : 276 (*1*), 282 (*4*).

144. *Arietellus setosus*, Giesbr.

Arietellus setosus, Giesbrecht, 1892.

Occurrence.—Four specimens, one female and three males, were taken on three stations off New Zealand, surface, 3 metres and 100–0 metres.

Remarks.—Length, ♀, 5·08 mm., ♂, 4·02–4·20 mm. Wolfenden (1911) has included *A. setosus* in his list of species taken in the Antarctic by the "Gauss," but he omits it from the detailed list of species taken on the separate stations, from which the depth, date, and locality might have been ascertained.

Records.—**30°–40°** S.: 80 (*1*), 109 (*2*), 118 (*1*).

145. *Arietellus aculeatus* (T. Scott).

Arietellus aculeatus, A. Scott, 1909; *Arietellus armatus*, Wolfenden, 1911.

Occurrence.—One male was taken in a surface haul by night off New Zealand.

Remarks.—Length, ♀, 4·44 mm. The form of the cephalothorax is similar to that of the female as figured by A. Scott. The 5th feet differ very little from those found in other species of the genus. It seems probable that *A. armatus* of Wolfenden is the same as this species.

Record.—**30°–40°** S.: 129 (*1*).

146. *Candacia longimana*, Claus.

Candacia longimana, Giesbrecht, 1892.

Occurrence.—Taken on several stations off New Zealand, always at or close to the surface.

Remarks.—Length, ♀, 3·7–3·9 mm., ♂, 3·35–3·5 mm.

Records.—**30°–40°** S.: 85 (*1*), 92 (*2*), 93 (*4*), 109 (*4*), 126 (*1*), 129 (*2*), 130 (*4*), 131 (*1*).

147. *Candacia falcifera*, n. sp. Fig. 28.

Description.—Female (fig. 28 *a*), length 3·7 mm. Abdomen (fig. 28 *b*) contained three and a half times in the length of the cephalothorax, but in the two specimens found the abdominal segments were much contracted. Last thoracic segment symmetrical, ending in short lateral points. Genital segment symmetrical not swollen ventrally. Antennules incomplete in all specimens, with second and third joints separated. The proportional length in 0·01 mm. of the joints proximal to the constriction are:

1	2	3	4	5	6	7
14	34	10	9	12	12	11

The exopodite of the first maxilla has all its setæ sub-equal. The second maxilla (fig. 28 *c*) has a moderately long second joint, the proximal spine of which is equal in length and thickness to the distal. First foot with inner edge seta absent on the first basal joint but present on the second. Terminal spines of all the swimming feet broken off. Fifth feet (fig. 28 *d*) symmetrical, three jointed, sickle shaped, the first two joints representing the handle and the long curved third joint, with its terminal seta continuing the curve, representing the blade. There are four small outer edge spines on the third joint but no inner edge setæ.

Male, length, 3·33–3·5 mm. Cephalothorax resembling that of the female. Abdomen (fig. 28 *e*) with a blunt thumb-like projection on the right side of the first segment. Clasping joints of the antennules missing in all specimens. Appendages of the cephalothorax similar to those of the female except the fifth feet (fig. 28 *f*) which are of the type found in *C. longimana* and *C. æthiopica*.

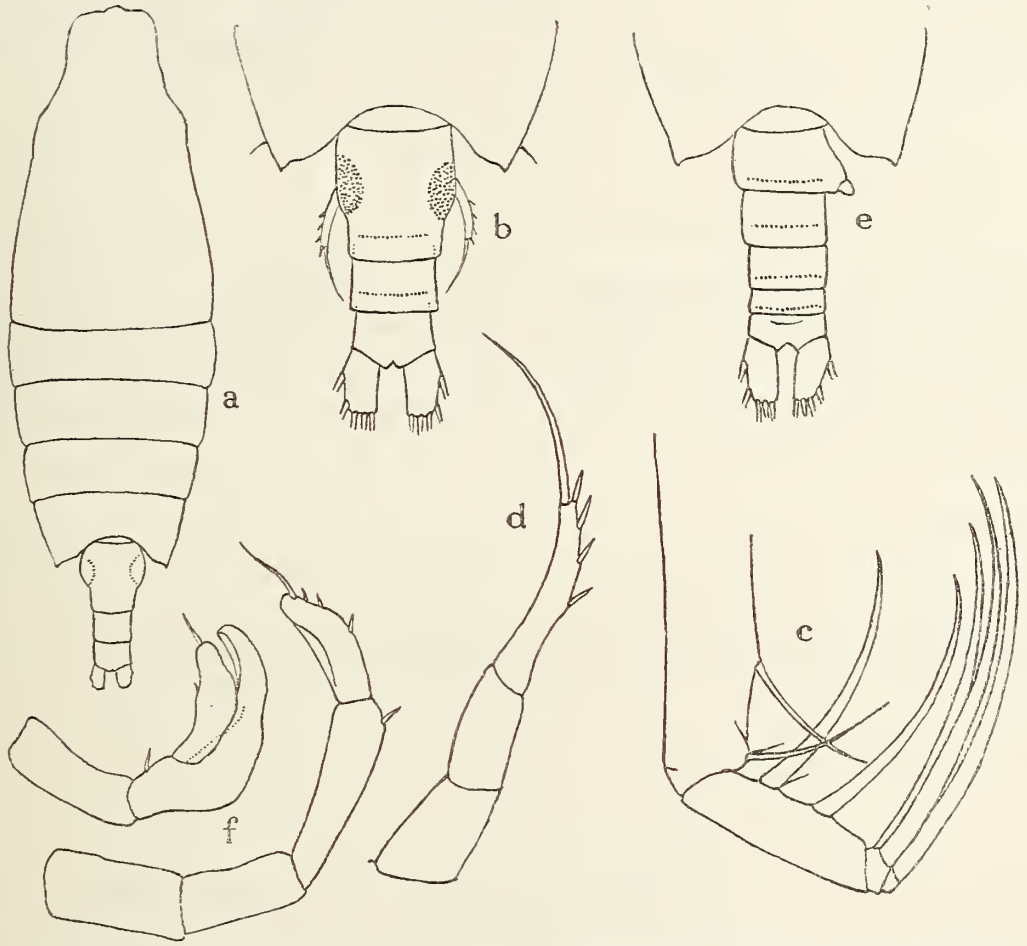

Fig. 28.—*Candacia falcifera*, n. sp. Female: *a*, dorsal view, × 24; *b*, abdomen, dorsal view, × 12; *c*, second maxilla, × 50; *d*, fifth foot, × 120; Male: *e*, abdomen, dorsal view, × 12; *f*, fifth feet, × 95.

Occurrence.—A few specimens in the Antarctic, one female at 160 metres, the remainder in vertical hauls from depths between 600 and 1750 metres.

Remarks.—This species has a general resemblance to *Candacia longimana*, to which it is evidently allied, but can be distinguished by its stouter form and shorter abdomen, by the form of the fifth feet of the female and the fifth thoracic segment of the male. The swimming feet are without brown pigment.

Records.—**66° 30′–76°** S.: 275 (*1*), 276 (*2*), 282 (*3*), 285 (*1*).

148. *Candacia æthiopica*, Dana.

Candace æthiopica, Giesbrecht, 1892.

Occurrence.—Taken in the North Atlantic between 23° 28′ N. and 27° 22′ N., in the South Temperate Atlantic and, very plentifully, off New Zealand.

Records.—North Temp. Atlantic: 66 (*1*), 67 (*4*), 68 (*4*).—Tropical Atlantic: 64 (*7*), 65 (*24*).—**30°–40°** S.: 81 (*1*), 83 (*4*), 84 (*3*), 85 (*90*), 86 (*40*), 92 (*5*), 93 (*156*), 106 (*3*), 107 (*70*), 109 (*18*), 110 (*38*), 114 (*130*), 118 (*1*), 119 (*1*), 120 (*50*), 126 (*53*), 129 (*225*), 130 (*6*), 132 (*10*), 137 (*3*), 139 (*2*).

149. *Candacia pachydactyla*, Dana.

Candace pachydactyla, Giesbrecht, 1892.

Occurrence.—In the Tropical Atlantic from 6° N. southwards.

Remarks.—The immature specimens recorded below, indicated by an asterisk, may be either *C. pachydactyla* or *C. æthiopica*, but are probably the former.

Records.—Tropical Atlantic: 39 (*1*), 40 (*2*), 43 (*6*), 50 (*41*), 52 (*59*), 53 (*13*), 56 (*70**), 57 (*20**), 58 (*1**), 59 (*1*), 63 (*7*).

150. *Candacia curta*, Dana.

Candace curta, Giesbrecht, 1892.

Occurrence.—In small numbers in the Tropical Atlantic.

Records.—Trop. Atlantic: 39 (*1*), 43 (*2*), 52 (*7*), 53 (*2*), 58 (*1*), 63 (*2*).

151. *Candacia bispinosa*, Claus.

Candace bispinosa, Giesbrecht, 1892.

Occurrence.—In the North Temperate and Tropical Atlantic, plentiful on a few stations but not taken between 23° 28′ N. and 18° S. Scarce off New Zealand.

Records.—North Temp. Atlantic: 60 (*60*), 67 (*12*), 68 (*28*).—Trop. Atlantic: 50 (*3*), 64 (*180*), 65 (*50*).—**30°–40°** S.: 83 (*1*), 85 (*1*), 93 (*8*), 120 (*3*).

152. *Candacia bipinnata*, Giesbrecht.

Candace bipinnata, Giesbrecht, 1892.

Occurrence.—The most plentiful species of *Candacia* off New Zealand. It was also taken at the Azores and off Rio de Janeiro.

Records.—North Temp. Atlantic: 70 (*6*).—Trop. Atlantic: 39 (*2*).—**30°–40°** S.: 81 (*10*), 83 (*6*), 84 (*28*), 85 (*135*), 86 (*80*), 87 (*6*), 89 (*4*), 92 (*41*), 93 (*1600*), 107 (*28*), 109 (*17*), 110 (*1*), 112 (*10*), 114 (*3*), 118 (*15*), 120 (*280*), 126 (*85*), 127 (*7*), 129 (*325*), 130 (*17*), 132 (*2*), 133 (*71*), 135 (*4*), 136 (*1*), 139 (*7*).

153. *Candacia varicans*, Giesbrecht.

Candace varicans, Giesbrecht, 1892.

Occurrence.—Taken once at the Azores and on a few stations off New Zealand.

Records.—North Temperate Atlantic: 70 (*1*).—**30°–40°** S.: 85 (*1*), 89 (*1*), 92 (*1*), 93 (*4*), 120 (*3*), 130 (*4*).

154. *Candacia simplex*, Giesbrecht.

Candace simplex, Giesbrecht, 1892.

Occurrence.—Taken on two stations off Rio de Janeiro. Not uncommon off New Zealand.

Remarks.—Length, ♀, 2·3 mm., ♂, 1·92–2·04 mm. (New Zealand); ♀, 1·85 mm., ♂, 1·92 mm. (Tropical Atlantic).

Records.—Trop. Atlantic: 40 (*1*), 43 (*2*).—**30°–40°** S.: 85 (*10*), 87 (*1*), 92 (*1*), 109 (*10*), 120 (*7*), 126 (*1*), 135 (*1*).

155. *Candacia cheirura*, Cleve. Fig. 29.

Candacia cheirura, Cleve, 1905.

Occurrence.—Several specimens were taken on four stations between the Auckland and Campbell Islands, south of New Zealand.

Remarks.—Length, ♀, 2·45–2·55 mm., ♂, 2·34–2·40 mm. This very distinct species was described by Cleve from collections made to the west of South Africa in the Benguela Current at depths of 250–350 metres. This would allow us to suppose that it is a normal inhabitant of the upper mesoplankton in the circumpolar current known as the West Wind Drift, in which the Benguela Current has its origin, in which case its occurrence in the present locality might have been expected.

Cleve's description and figures make the identification of the female quite certain, the much thickened furcal setæ and the remarkable ventral projections on the genital and second abdominal segments affording easily recognised diagnostic characters (figs. 29 *a*, *b*). The figures of the male given by Cleve differ in some points from the "Terra Nova" specimens. In the latter the point on the right side of the fifth thoracic segment is not so long and slender and the lateral process of the first abdominal segment is stouter and blunter (fig. 29 *c*). There are also small differences in the form of the clasping antennule (fig. 29 *d*) and of the 5th feet (fig. 29 *e*).

Records.—**50°–60°** S.: 235 (*10*), 236 (*1*), 238 (*9*), 241 (*12*).

156. *Calanopia Aurivillii*, Cleve.

Calanopia Aurivillii, A. Scott, 1909.

Occurrence.—On one station off New Zealand, one female and two males in a surface haul.

Remarks.—Length, ♀, 1·45 mm., ♂, 1·38 mm.
Record.—**30°–40°** S.: 114 (*3*).

157. *Calanopia americana*, Dahl.

Calanopia americana, A. Scott, 1909.

Occurrence.—On three stations off Rio de Janeiro, surface to 2 metres.

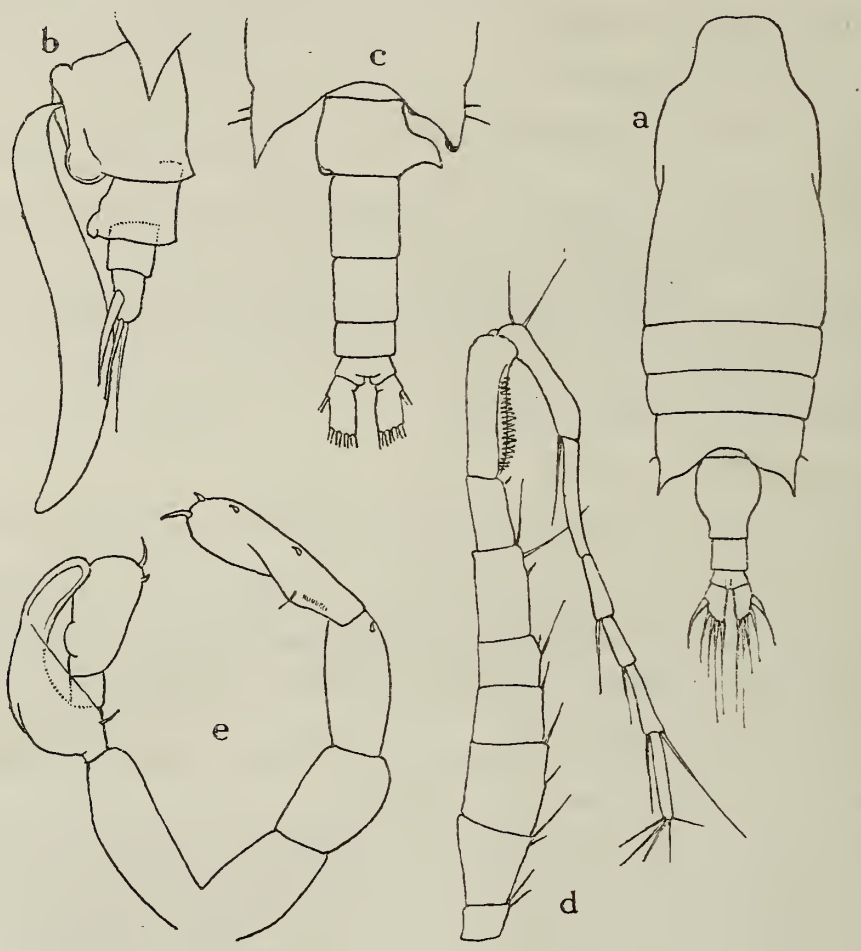

Fig. 29.—*Candacia cheirura.* Female: *a*, dorsal view, × 31; *b*, abdomen, lateral view, × 55. Male: *c* abdomen, dorsal view, × 58; *d*, clasping joints of right antennule, × 82; *e*, fifth feet, × 104.

Remarks.—Length, ♀, 1·47–1·8 mm. This seems to be exclusively a West Atlantic form.

Records.—Tropical Atlantic: 39 (*2*), 40 (*161*), 43 (*2*).

158. *Labidocera acutifrons* (Dana).

Labidocera acutifrons, Giesbrecht, 1892.

Occurrence.—Several specimens in a haul at two metres off Rio de Janeiro.
Record.—Tropical Atlantic: 40 (*20*).

159. *Labidocera Nerii* (Kröyer).

Labidocera Nerii, Giesbrecht, 1892.

Occurrence.—In the Atlantic from the equator to 6° 10′ N.

Remarks.—Length, ♀, 3·06 mm., ♂, 3·00 mm.

Records.—Trop. Atlantic: 59 (*2*), 61 (*90*), 62 (*14*), 63 (*470*).

160. *Labidocera Cervi*, Krämer. Fig. 30.

Labidocera Cervi, Krämer, 1895, Brady, 1899.

Occurrence.—Taken a few times off North Island, New Zealand, not far from

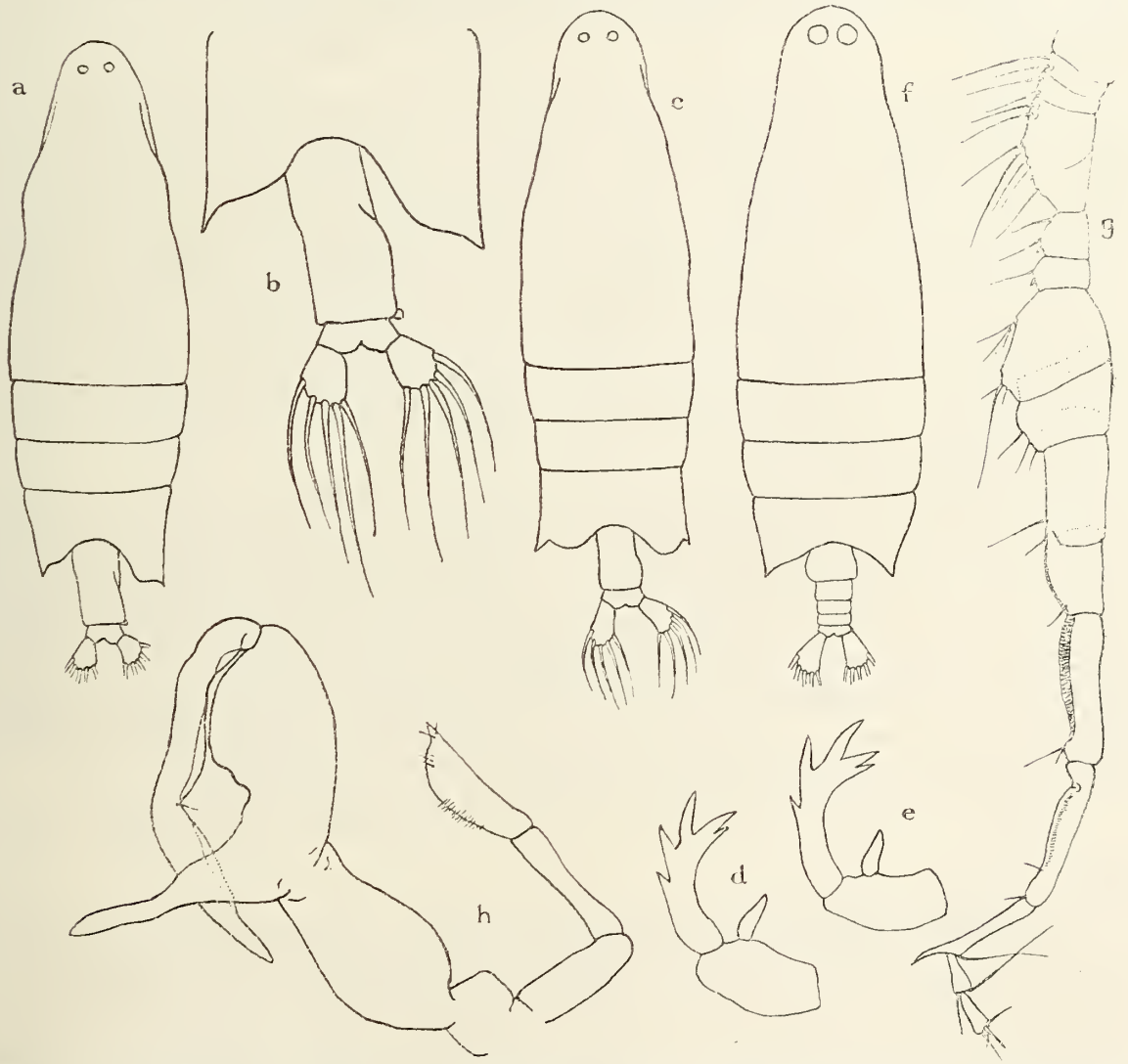

Fig. 30.—*Labidocera Cervi*. Female: *a*, dorsal view, × 28; *b*, abdomen, dorsal view, × 49; *c*, dorsal view of specimen from Melbourne Hbr., × 28; *d*, fifth foot; *e*, fifth foot of specimen from Melbourne Hbr. Male: *f*, dorsal view, × 39; *g*, right antennule, proximal joints omitted; *h*, fifth feet, × 69.

shore except on Station 110 which is about ten miles from Three Kings Islands. A variety was taken in Melbourne Harbour.

Remarks.—Length, ♀, 2·8–3·3 mm., ♀, 2·8–3·1 mm. This species was described by Krämer from a female specimen taken in the Hauraki Gulf, New Zealand. Krämer's description and figures though deficient in some respects are sufficient to show that he had the present species before him. The short and stout 5th feet with large spines which he figures are very characteristic.

This species is without crest or cephalic spines. The last thoracic segment of the female (fig. 30 *a*) is produced on each side into a wing ending in a sharp point, the wing on the right side being noticeably longer than on the left. The abdomen is two-jointed (fig. 30 *b*), the first joint very long with a small papilla situated ventrally on the right side but just visible in dorsal view. The genital boss is moderately prominent.

A few males were found. Krämer did not describe these, but Brady (1899) has given a few tolerably accurate figures. They have symmetrical cephalothorax and abdomen (fig. 30 *f*) except that the first abdominal segment is slightly more swollen on the left than on the right side. The right clasping antennule (fig. 30 *g*) has feebly-developed toothing. The 18th joint is not produced backwards to overlap the 17th; it has a row of fine marginal teeth which, when the hinge between the 18th and 19+20+21st is bent, engage with a double row of fine beading on the latter composite joint. The 22nd joint is produced distally beyond the junction with the 23rd into a strong spine about as long as the 23rd joint. The 5th feet of a New Zealand specimen are figured (fig. 30 *h*).

The Melbourne Harbour female specimens (fig. 30 *c*) differed from those from New Zealand in having a more symmetrical fifth thoracic segment, which is produced equally on both sides. The right ramus of the furca is directed obliquely outwards instead of being almost parallel to the left ramus and the small papilla, which is present on the right side of the abdomen in the New Zealand specimens, is absent. The 5th feet (figs. 30 *d*, *e*) of the females are similar in the specimens from both localities and no differences were observed between the males, and for this reason it seems probable that the Melbourne Harbour specimens represent only a local variation.

Records.—**30°–40°** S.: 110 (*1*), 133 (*5*), 136 (*4*), 148 [a (*5*), b (*8*)], 161 (*28*).

161. *Labidocera brasiliense*, n. sp. Fig. 31.

Description.—Female, length 2·56 mm. (fig. 31 *a*). Cephalothorax, in mid-dorsal line, 1·96 mm., abdomen 0·6 mm. Cephalothorax an elongated oval without lateral hooks or crest, Dorsal lenses small, rostrum moderately long with stout and straight rami (fig. 31 *b*). Last thoracic segment symmetrical, produced on each side into stout points, with acute tips in lateral view, which reach back to the level of the middle of the genital segment.

Abdomen (fig. 31 *c*, *d*) symmetrical, three-jointed, proportional lengths of abdominal joints and furca 20, 9, 3, 12. Genital segment barrel shaped, about one and a half times as long as wide in dorsal view, without lateral spinulation. Second abdominal

segment about as long as broad. Anal segment (not shown in the figure) imperfectly separated from the furca. Furcal rami oval.

Fifth feet (fig. 31 *e*) symmetrical with two-jointed basipodite, small pointed endopodite and curved tapered exopodite, about three times as long as the endopodite, with forked tip the inner prong of the fork being much shorter than the outer. Seta on the posterior face of the second joint of the basipodite very short. There was no sign of teeth on the outer margin of the exopodite.

Occurrence.—One specimen in a haul at 2 metres off Rio de Janeiro.

Remarks.—This species is very closely allied to *L. æstiva* described by Wheeler (1901) from specimens taken close to shore at Woods Hole, but differs in the following points: the size is slightly larger, 2·56 mm. instead of 1·75–2·0 mm.: the genital segment is narrower and is without minute hairs on its sides, the second abdominal segment is only as long as broad instead of twice as long and the 5th feet have a tapered exopodite bifid at the tip and about three times as long as the endopodite. In *L. æstiva* the exopodite of the 5th feet is of uniform width, twice as long as the endopodite and trifid at the tip.

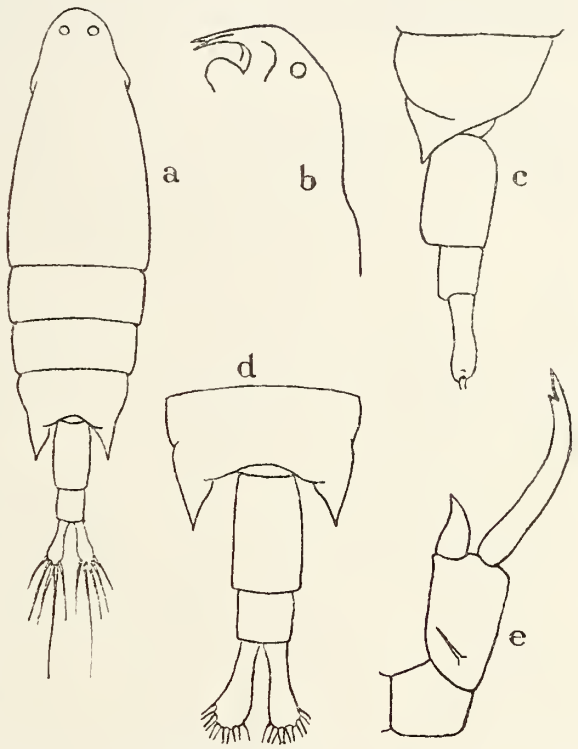

Fig. 31.—*Labidocera brasiliense*, n. sp. Female: *a*, dorsal view, × 28·5; *b*, anterior portion of cephalon, lateral view; *c*, abdomen, lateral view, × 51; *d*, abdomen, dorsal view, × 51; *e*, fifth foot, × 130.

Record.—Tropical Atlantic: 40 (*1*).

162. *Pontella securifer*, Brady.

Pontella securifer, Giesbrecht, 1892.

Occurrence.—On three stations in the Tropical Atlantic, at the surface.

Remarks.—Length, ♀, 4·02–4·2 mm., ♂, 3·6–4·08 mm.

Records.—Trop. Atlantic: 50 (*2*), 61 (*1*), 64 (*1*).

163. *Pontella novæ-zealandiæ*, n. sp. Fig. 32.

Description.—Female (fig. 32 *a*), length 6·0–6·2 mm. Cephalothorax two and a half times as long as the abdomen, with rudimentary crest and lateral cephalic hooks. Last segment of thorax symmetrical, produced into sharp pointed wings on each side. Rostrum (fig. 32 *e*) moderately slender with slight indication of a lens. Abdomen

(fig. 32 *b*) three-jointed; first segment with two dorsal processes, the anterior one blunt and directed dorsally, the posterior one tapering to a point and overlapping the second segment which has a laterally directed winged process on the left side; anal segment

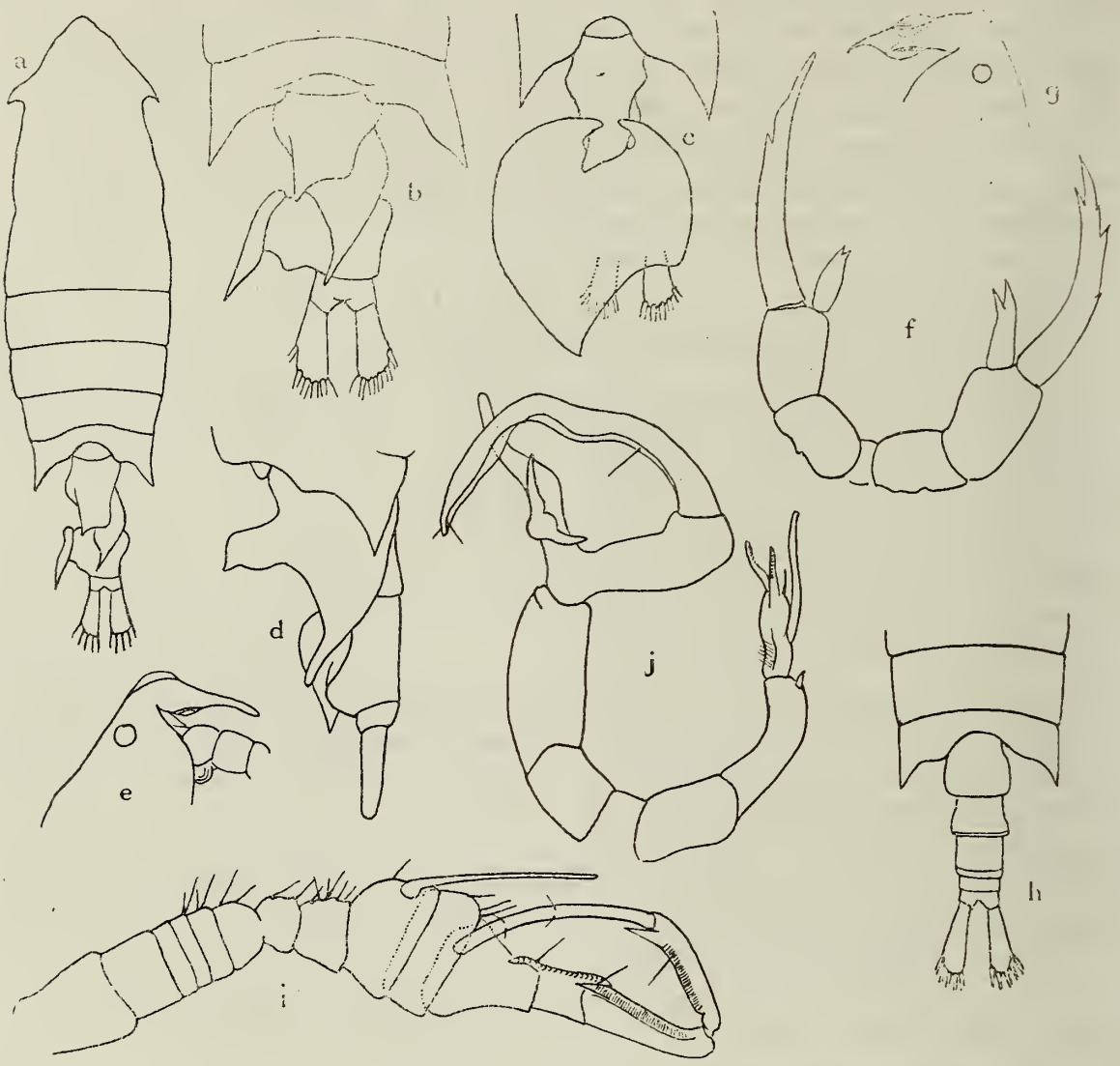

Fig. 32.—*Pontella novæ-zelandiæ*, n. sp. Female: *a*, dorsal view, × 13·5; *b*, abdomen, dorsal view, × 24; *c*, abdomen, dorsal view, showing accessory plate, × 21; *d*, abdomen, from right side, × 24; *e*, anterior portion of cephalon; *f*, fifth feet, × 55. Male: *g*, anterior portion of cephalon; *h*, abdomen, dorsal view; *i*, right antennule, × 75; *j*, fifth feet, × 43.

short, furca symmetrical, the furcal rami being about three times as long as their greatest width.

Antennules short, reaching to the middle of the third thoracic segment. Other appendages without distinctive specific characters except the 5th feet (fig. 32*f*). These are not quite symmetrical. The right exopodite is slightly the shorter and has a sharp terminal point, a well-marked inner sub-terminal tooth and a smaller outer edge tooth

between two much smaller ones. The left exopodite lacks the inner-edge tooth and the three outer-edge teeth are much reduced, the distal one being sometimes hardly indicated. The endopodite on the right side is the larger and ends in two stout teeth. On the left side the endopodite ends in two much smaller teeth.

Male, length 4·9–5·4 mm. Cephalothorax symmetrical with lateral cephalic hooks and small crest ending in a blunt tooth. Last thoracic segment produced into lateral spines. Rostrum (fig. 32 *g*) with well-developed lens. Abdomen (fig. 32 *h*) symmetrical with segments and furca in the proportion 22, 18, 23, 15, 9, 35.

Furcal rami long and narrow, contained about $2\frac{1}{2}$ times in the length of the rest of the abdomen.

Clasping antenna (fig. 32 *i*) of the type found in *P. Lobiancoi*, the 13–15 joints being moderately swollen, 16th long, 17th short, with a slightly toothed or rather beaded upper margin, and produced backwards to overlap the 16th ; 18th and 19+20+21st joints finely toothed and with a well-marked hinge between them ; 22nd to 24th joints fused except for a faintly-marked segmentation between 23rd and 24th joints.

The right fifth foot (fig. 32 *j*) has a two-jointed basipodite and a two-jointed exopodite forming a " hand " ; the palm or first joint of the exopodite has at its proximal end a long slender thumb-like process with a two-pronged projection arising from its base ; the second joint or finger is very long and slender. The left fifth foot has a two-jointed basipodite and a one-jointed exopodite with a long outer spine arising near its base, a very small distal outer edge spine and two terminal spines slightly modified.

Occurrence.—In small numbers in several hauls off North Island, New Zealand, surface to 3 metres.

Remarks.—Krämer (1896) has described a crested species of *Pontella* from New South Wales, but the present species can be distinguished from it by its great development of abdominal processes in the female and by the form of the 5th feet in the male. In these characters it differs from all the twenty-one species of which I have seen descriptions, viz. Giesbrecht and Schmeil (1898) 14, Scott (1909) 4, Wheeler (1901) 1, Sewell (1912), 2.

In about one-third of the females the abdomen was covered by a broad asymmetrical chitinous shield (fig. 32 *c*) attached by its centre to the dorsal surface of the genital segment and encircling the dorsal process of the segment. It apparently forms an accessory apparatus to the spermatophore, which in some specimens was attached on the right side of the abdomen beneath the shield, and seems to correspond to the " begleitplatte " (Steuer, 1923) found in some species of the allied genus *Acartia*, in which genus, however, it is symmetrical, and is attached to the under surface of the genital segment.

Records.—**30°–40°** S. : 89 (*42*), 93 (*4*), 100 (*3*), 107 (*1*), 108 (*3*), 109 (*16*), 110 (*6*), 112 (*3*), 127 (*1*).

164. *Pontellopsis regalis* (Dana).

Monops regalis, Giesbrecht, 1892.

Occurrence.—One specimen, a female, length 3·6 mm., was taken in the Tropical Atlantic.

Record.—Trop. Atlantic : 50 (*1*).

165. *Pontellopsis perspicax* (Dana).

Monops perspicax, Giesbrecht, 1892.

Occurrence.—Common on the Tropical Atlantic stations south of the equator.

Remarks.—Length, ♀, 2·6–2·8 mm., ♂, 2·4 mm.

Records.—Trop. Atlantic : 50 (*1*), 52 (*7*), 56 (*23*), 57 (*17*), 59 (*1*).

166. *Pontellopsis brevis* (Giesbr.).

Monops brevis, Giesbrecht, 1892.

Occurrence.—Common on two stations off Rio de Janeiro.

Remarks.—Length, ♀, 2·04–2·22 mm., ♂, 1·86 mm. These specimens were taken close to Giesbrecht's original locality.

Records.—Trop. Atlantic : 39 (*140*), 40 (*14*).

167. *Pontellina plumata* (Dana).

Pontellina plumata, Giesbrecht, 1892.

Occurrence.—Frequent throughout the Atlantic and off New Zealand.

Records.—North Temp. Atlantic : 10 (*1*).—Trop. Atlantic : 50 (*25*), 52 (*61*), 53 (*1*), 56 (*39*), 57 (*90*), 58 (*1*), 61 (*2*), 62 (*11*), 63 (*1*), 64 (*4*), 65 (*24*).—**30°–40°** S. : 87 (*1*), 89 (*1*), 92 (*4*), 93 (*8*), 107 (*1*), 133 (*7*), 136 (*1*), 147 (*1*).

168. *Paralabidocera antarctica* (I. C. Thompson).

Paralabidocera Hodgsoni, Wolfenden, 1908.

Occurrence.—Found chiefly in the extreme south of the Antarctic but only once in a haul made under the ice. A few specimens were taken north of the Antarctic Circle, one immature specimen as far north as 42° 06′ S.

Remarks.—Length, ♀, 1·92–2·10 mm., ♂, 1·56–1·75 mm. This species was first described by I. C. Thompson (1898) from the South Shetlands under the name of *Paracartia antarctica* and, as A. Scott (1909) has pointed out, was again described as a new genus and species by Wolfenden (1908) from the "Discovery" collections, under the name of *Paralabidocera Hodgsoni*. Steuer (1923) has excluded it from the Genus *Paracartia*, consequently the correct designation appears to be *Paralabidocera antarctica*.

Records.—**40°–50°** S. : 200 (*1**).—**66° 30′–76°** S. : 221 (*11*).—**76°–78°** S. : 222 (*4*), 223 (*11*), 323 [54 (*13*)], 329 (*100*), 330 (*300*), 333 (*12*), 345 (*5*), 354 (*1*).

169. *Acartia Clausi*, Giesbr.

Acartia Clausi, Giesbrecht, 1892 ; *Acartia ensifera*, Brady, 1899.

Occurrence.—North Temperate Atlantic, north of 38° N., common. One specimen close to the equator. Common off New Zealand, especially in the Bay of Islands, and reaching as far south as 54° S. One female was found in a townetting vertical haul 0–350 metres in 77° 30′ S., but as three specimens of *Corycæus inuncus*, which did not occur elsewhere in the Antarctic, were also found in the same gathering accidental contamination may be suspected.

Remarks.—The specimens from Stations 3 and 4 measured, ♀, ♂, 1·02 mm. ; the ♀ from Stations 70 and 61 1·12 mm. In the females from the latter stations the spinules on the 5th thoracic segment and the abdominal segments were absent and the 2nd and 3rd abdominal segments were more barrel shaped in dorsal view than in the typical *A. clausi*. The 5th feet were of the normal *A. clausi* type.

The New Zealand specimens, length, ♀, 1·12–1·25 mm., ♂, 1·05–1·18 mm., to which Brady (1899) has given the name of *A. ensifera*, were indistinguishable from *A. clausi*. The figures of the 5th feet of both male and female given by Brady show some small differences from those of *A. clausi*, the seta on the basal joint in the female being equal to claw-like second joint, and the seta on the second basal joint on the right side in the male being absent. In all the specimens which I examined the basal seta in the female was longer than the claw and, in the male, setæ were present on the second basal joints on both sides. The lateral spinules on the 5th thoracic segment of the female were not always present but in most cases from three to five spinules could be clearly seen. One female, with spermatophore, was found, the fifth feet of which were of the male type.

Records.—North Temp. Atlantic : 3 (*180*), 4 (*22*), 70 (*1*). Tropical Atlantic : 61 (*1*).—**30°–40°** S. : 71 (*24*), 72 (*18*), 73 (*156*), 75 (*8*), 76 (*120*), 82 (*3*), 94 (*55*), 97 (*10*), 98 (*3*), 100 (*15*), 132 (*490*), 133 (*12*), 136 (*29*), 137 (*5*), 138 (*4*), 148 [a (*200*), b (*150*), c (*120*), d (*78*), e (*140*), f (*748*), g (*28*), h (*90*), i (*280*)].—**40°–50°** S. : 204 (*2*), 242 (*3*).—**50°–60°** S. : 250 (*40*).

170. *Acartia negligens*, Dana.

Acartia negligens, Giesbrecht, 1892.

Occurrence.—Common in the Atlantic. A few specimens were taken on four stations off New Zealand.

Remarks.—Length, ♀, 1·1–1·2 mm., ♂, 0·96–1·02 mm. (Atlantic).

Records.—North Temperate Atlantic : 8 (*1*), 11 (*4*), 13 (*3*), 14 (*3*), 18 (*3*), 66 (*70*), 67 (*30*), 68 (*100*).—Tropical Atlantic : 25 (*6*), 59 (*2*), 63 (*1*), 64 (*230*), 65 (*133*).—South Temp. Atlantic : 310 (*140*), 311 (*11*).—**30°–40°** S. : 89 (*4*), 108 (*1*), 140 (*4*),—**40°–50°** S. : 201 (*1*).

171. *Acartia Danæ*, Giesbr.

Acartia Danæ, Giesbrecht, 1892.

Occurrence.—Taken off the Azores and off Rio de Janeiro in the Atlantic, very common off New Zealand.

Records.—North Temp. Atlantic: 70 (*3*).—Tropical Atlantic: 39 (*1*), 40 (*20*).—**30°–40°** S.: 71 (*48*), 72 (*3*), 73 (*5*), 74 (*8*), 75 (*22*), 76 (*85*), 77 (*29*), 78 (*1*), 82 (*3*), 83 (*345*), 84 (*360*), 85 (*19*), 86 (*1200*), 87 (*74*), 92 (*8*), 93 (*12*), 94 (*5*), 97 (*14*), 99 (*2*), 100 (*15*), 101 (*1*), 103 (*12*), 104 (*8*), 105 (*14*), 106 (*305*), 107 (*140*), 109 (*2*), 112 (*155*), 113 (*10*), 114 (*200*), 116 (*2*), 118 (*400*), 119 (*10*), 120 (*9*), 122 (*2*), 127 (*5000*), 128 (*3840*), 129 (*1*), 132 (*2700*), 133 (*15*), 135 (*6*), 136 (*2*), 137 (*31*), 140 (*57*), 146 (*50*), 147 (*57*), 148 [f (*2*), g (*1*)], 203 (*16*).—**50°–60°** S.: 235 (*1*).

172. *Oithona plumifera*, Baird.

Oithona plumifera, Rosendorn, 1917.

Occurrence.—Found in very varying numbers over almost the whole region traversed except within the Antarctic Circle.

Remarks.—Length, ♀, 1·08–1·38 mm. Although the total variation in length was great the limits on any one station were much less, *e.g.* 1·08–1·17 mm. on Station 100 (30°–40° S.), 1·25–1·39 mm. on Station 39 (Trop. Atlantic), 1·35–1·38 mm. on Station 235 (50°–60° S.). The plumose setæ were only seen on comparatively few of the New Zealand specimens.

Records.—North Temp. Atlantic: 18 (*1*), 68 (*168*).—Trop. Atlantic: 25 (*1*), 39 (*240*), 40 (*15*), 43 (*30*), 50 (*270*), 52 (*1*), 56 (*2*), 57 (*1*), 58 (*3*), 59 (*1*), 61 (*60*), 62 (*520*), 63 (*20*), 64 (*40*).—**30°–40°** S.: 71 (*24*), 72 (*2*), 73 (*36*), 74 (*4*), 75 (*10*), 76 (*120*), 77 (*2*), 82 (*30*), 83 (*20*), 84 (*6*), 85 (*15*), 86 (*2*), 97 (*15*), 98 (*1*), 100 (*17*), 103 (*4*), 104 (*1*), 105 (*1*), 107 (*80*), 110 (*1*), 112 (*15*), 113 (*1*), 114 (*50*), 116 (*1*), 117 (*2*), 119 (*8*), 120 (*1*), 128 (*480*), 137 (*2*), 140 (*1*), 146 (*45*), 148 [b (*20*), d (*2*), e (*2*), f (*3*), i (*2*)], 203 (*6*).—**40°–50°**–S.: 201 (*40*).—**50°–60°** S.: 197 (*20*), 232 (*1*), 235 (*4*), 241 (*1*). 250 (*40*), 251 (*25*), 305 (*20*).

173. *Oithona tenuis*, Rosendorn.

Oithona tenuis, Rosendorn, 1917.

Occurrence.—On one station in the Tropical Atlantic and two off New Zealand.

Remarks.—Length, ♀, 1·15–1·22 mm. It can be distinguished from *O. linearis* Giesbrecht, which Rosendorn considers to be an extreme form of *O. setigera*, by having only two outer-edge spines on the third joint of the exopodite of the 1st foot.

Records.—Trop. Atlantic: 25 (3).—**30°–40°** S.: 77 (*1*), 97 (*1*).

174. *Oithona setigera*, Dana.

Oithona setigera, Rosendorn, 1917.

Occurrence.—On one station in the Tropical Atlantic and four off New Zealand.

Remarks.—Length, ♀, 1·80–1·85 (Trop. Atlantic), 1·25–1·80 (off New Zealand). Its scarcity is remarkable considering the large number of records given by Rosendorn from the "Valdivia" collections.

Records.—Trop. Atlantic: 50 (*72*).—**30°–40°** S.: 97 (*1*), 98 (*1*), 100 (*3*), 146 (*20*).

175. *Oithona frigida*, Giesbrecht.

Oithona frigida, Giesbrecht, 1902.

Occurrence.—Only found within the Antarctic Circle and most numerous in hauls made beneath the ice.

Remarks.—Length, ♀, 1·25–1·28 mm. The form *pscudofrigida*, described by Rosendorn from the Tropical Atlantic and Indian Oceans, was not seen but may have been mistaken for *O. plumifera* as it was impracticable to examine closely more than a small sample of the specimens from each station.

Records.—**66° 30′–76°** S.: 172 (*4*), 177 (*2*), 180 (*2*).—**76°–78°** S.: 317 [5 (*14*), 9 (*1*), 17 (*3*), 18 (*42*), 22 (*30*), 23 (*10*), 29 (*5*), 30 (*20*), 31 (*61*), 37 (*50*), 38 (*40*)], 323 [44 (*2*)], 357 [53 (*22*), 59 (*2*), 60 (*46*)].

176. *Oithona similis*, Claus.

Oithona similis, Rosendorn, 1917.

Occurrence.—Only once taken in the Atlantic but common over the whole area traversed from New Zealand to the ice barrier. It was common in hauls made under the ice.

Remarks.—Length, ♀, 0·76–1·08 mm., usually 0·85–1·00 mm. Some of the Antarctic specimens had a rather broad and flattened cephalothorax but their swimming feet and other appendages agreed with the typical form.

Records.—Trop. Atlantic: 23 (*1*).—**30°–40°** S.: 71 (*480*), 72 (*4*), 73 (*468*), 74 (220), 76 (*1090*), 77 (*60*), 82 (*300*), 83 (*20*), 84 (*7*), 85 (*5*), 94 (*1*), 97 (*4*), 98 (*13*), 99 (*67*), 104 (*40*), 107 (*77*), 106 (*1*), 116 (*9*), 117 (*21*), 119 (*42*), 128 (*5280*), 148 [a (*1*), d (*2*), e (*1*), f (*20*)].—**40°–50** S.: 201 (*200*).—**50°–60°** S.: 160 (*400*), 197 (*20*), 197a (*240*), 198 (*30*), 199 (*20*), 232 (*13*), 236 (*1*), 240 (*600*), 241 (*500*), 252 (*4*), 256 (*6*), 259 (*110*).—**60°–66° 30′** S. 168 (*430*), 214 (*230*), 215 (*850*), 216 (*840*), 228 (*690*), 229 (*1*), 230 (*950*), 264 (*17*).—**66° 30′–76°** S.: 225 (*1*), 226 (*4*), 227 (*190*).—**76°–78°** S.: 222 (*20*), 223 (*9*), 315 (*100*), 317 [4 (*308*), 5 (*343*), 6 (*75*), 7 (*224*), 9 (*374*), 10 (*1120*), 11 (*38*), 15 (*370*), 17 (*341*), 18 (*840*), 19 (*283*), 21 (*308*), 22 (*330*), 23 (*80*), 24 (*2100*), 29 (*847*), 30 (*1460*), 31 (*1250*), 37 (*980*), 38 (*1160*)], 318 (*10*), 323 [39 (*10*), 41 (*60*), 43 (*13*), 44 (*108*), 48 (*3*)], 325 (*242*), 329 (*1*), 342 (*28*), 345 (*94*), 346 (*24*), 347 (*50*), 351 [53 (*4444*), 57 (*6900*), 59 (*820*), 60 (*1560*), 61 (*57*), 62 (*99*), 63 (*50*), 64 (*50*), 65 (*280*)], 352 (*3900*).

177. *Ratania atlantica*, Farran.

Ratania atlantica, Farran, 1926.

Occurrence.—Two specimens, females, in vertical hauls from 600 and 1750 metres in the Antarctic.

Remarks.—Lengths, ♀, 2·75 mm. (ceph. th. 1·8 mm., abd. 0·95 mm.) and 2·50 mm. (ceph. th. 1·75 mm., abd. 0·85 mm.). Though slightly larger and with proportionately broader cephalothorax than the type specimen from the Bay of Biscay they agree with it in the form of the abdomen and appendages and differ from *R. flava*.

Records.—**66° 30′–76°** S.: 276 (*1*), 285 (1).

178. *Oncœa venusta*, Philippi.

Oncœa venusta, Giesbrecht, 1892.

Occurrence.—The most plentiful species of *Oncœa* in the collection, occurring throughout the Atlantic and off New Zealand, but not further south than 36° S.

Remarks.—Length, ♀, 1·08–1·16 mm., ♂, 0·78–0·81 mm. These lengths and the following records refer to the typical form with a broad pear-shaped cephalothorax.

Records.—North Temp. Atlantic: 8 (*21*), 11 (*14*), 66 (*55*), 67 (*24*), 68 (*210*).—Trop. Atlantic: 39 (*260*), 40 (*250*), 43 (*20*), 50 (*180*), 52 (*135*), 53 (*30*), 56 (*4*), 57 (*30*), 58 (*43*), 59 (*150*), 61 (*210*), 62 (*110*), 63 (*180*), 64 (*240*), 65 (*100*).—South Temp. Atlantic: 310 (*50*), 311 (*4*).—**30°–40°** S.: 71 (*46*), 72 (*13*), 73 (*2*), 75 (*28*), 76 (*3*), 77 (*11*), 78 (*21*), 81 (*20*), 82 (*7*), 83 (*132*), 84 (*345*), 85 (*360*), 86 (*4240*), 87 (*250*), 89 (*2*), 92 (*1*), 93 (*1*), 97 (*20*), 98 (*1*), 99 (*1*), 100 (*16*), 106 (*70*), 107 (*35*), 108 (*20*), 109 (*1*), 110 (*1*), 112 (*403*), 114 (*680*), 117 (*1*), 118 (*300*), 119 (*1*), 120 (*4400*), 127 (*1750*), 128 (*960*), 132 (*2000*), 137 (*215*), 138 (*2*), 140 (*50*), 146 (*10*), 147 (*1*), 148 [a (*2*)].

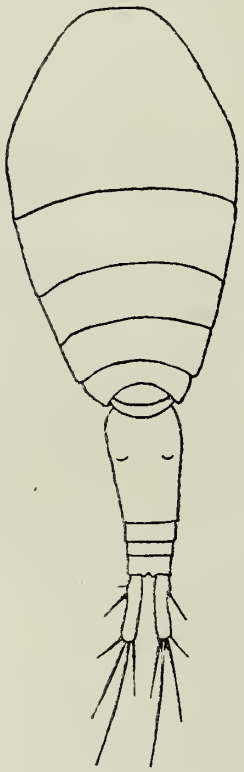

Fig. 33.—*Oncœa venusta*, var. *venella*, nov. Female, dorsal view, × 110.

178*a*. *Oncœa venusta*, var. *venella*, nov. Fig. 33.

Occurrence.—In the same areas as the typical form and usually on the same stations but in much smaller numbers. It also occurred on three stations to the south of New Zealand.

Remarks.—Length, ♀, 0·92–1·07 mm. It differs from the typical form by its smaller size and more uniformly oval and narrower cephalothorax (fig. 33), which has not the characteristic pear-shaped appearance of the larger form in dorsal view. The forebody is also slightly longer in proportion to the hind body than in the typical form, the proportion being ca. 9 : 6 instead of 9 : 7. Giesbrecht probably includes this form when he says (1892) that specimens of *O. venusta* from the Atlantic range in size from 0·85–1·33 mm. as against 1·1–1·27 mm. in the Mediterranean. The appendages are similar to those of the typical *O. venusta* and also the colour, judging by formaline specimens.

Records.—North Temp. Atlantic: 66 (*6*), 68 (*3*).—Trop. Atlantic: 43 (*1*), 52 (*18*),

58 (*3*), 59 (*1*), 62 (*3*), 63 (*5*).—South Temp. Atlantic: 310 (*1*).—**30°–40°** S.: 73 (*2*), 74 (*8*), 84 (*3*), 113 (*1*), 114 (*1*), 140 (*1*).

179. *Oncæa media*, Giesbrecht.

Oncæa media, Giesbrecht, 1892.

Occurrence.—Common throughout all the region traversed, as far as North Island, New Zealand. Two specimens, if no mistake has occurred, were taken as far south as Ross Island in the Antarctic.

Remarks.—Length, ♀, 0·75–0·78 mm. (North Temp. Atlantic); ♀, 0·84–0·95 mm. (Trop. Atlantic); ♀, 0·84–0·95 mm., ♂, 0·58–0·65 mm. (off New Zealand). The crimson colour of the abdomen and the crimson markings on the cephalon and appendages seem to be retained indefinitely in formaline.

Records.—North Temp. Atlantic: 11 (*6*), 18 (*1*), 66 (*2*), 68 (*7*).—Trop. Atlantic: 39 (*80*), 40 (*320*), 43 (*2*), 52 (*18*), 53 (*4*), 56 (*5*), 57 (*70*), 58 (*7*), 59 (*6*), 61 (*4*), 62 (*10*), 63 (*60*), 64 (*6*), 65 (*12*).—South Temp. Atlantic: 311 (*1*).—**30°–40°** S.: 74 (*8*), 76 (*10*), 77 (*12*), 78 (*1*), 82 (*10*), 83 (*85*), 84 (*6*), 85 (*45*), 86 (*26*), 87 (*46*), 92 (*1*), 98 (*1*), 101 (*40*), 105 (*2*), 108 (*5*), 112 (*60*), 114 (*30*), 117 (*7*), 119 (*3*), 120 (*490*), 128 (*4800*), 134 (*350*), 137 (*70*), 140 (*4*), 146 (*3*), 148 [b (*10*), c (*1*), d (*3*), e (*8*), i (*10*)].—**40°–50°** S.: 201 (*4*). —**76°–78°** S.: 346 (*2*).

180. *Oncæa mediterranea*, Claus.

Oncæa mediterranea, Giesbrecht, 1892.

Occurrence.—Scarce in the Atlantic but common off New Zealand. A small colourless form was found south of New Zealand in 54° S.

Remarks.—Length, ♀, 1·12–1·36 mm. (Atlantic); ♀, 1·25–1·32 mm. (off New Zealand); ♀, 1·17–1·18 (50°–60° S.). Most of the New Zealand specimens retained their orange or golden colour after preservation.

Records.—North Temp. Atlantic: 67 (*3*), 68 (*1*).—Trop. Atlantic: 63 (*1*), 64 (*10*), 65 (*8*).—**30°–40°** S.: 75 (*1*), 81 (*5*), 84 (*75*), 85 (*1820*), 86 (*280*), 87 (*50*), 89 (*2*), 92 (*1*), 97 (*8*), 100 (*2*), 105 (*1*), 106 (*105*), 107 (*50*), 112 (*12*), 114 (*20*), 120 (*9*), 126 (*1*), 132 (*40*) 137 (*10*), 146 (*1*), 148 [i (*1*)].—**50°–60°** S.: 251 (*1*), 252 (*1*), 256 (*1*).

181. *Oncæa conifera*, Giesbrecht.

Oncæa conifera, Giesbrecht, 1892.

Occurrence.—Not taken in the Atlantic but common off New Zealand and extending southwards to the south of 77° S. where it was taken three times in hauls beneath the ice.

Remarks.—Length, ♀, 1·16–1·38 mm. Giesbrecht (1902) has recorded this species from the Antarctic and has pointed out some points in which the Antarctic differs from the typical form. These differences, namely the shorter furca and the genital

segment considerably larger than the rest of the abdomen, were noted in the specimens from south of 60° S. The New Zealand specimens resembled the Mediterranean type.

Records.—**30°–40°** S.: 74 (*1*), 75 (*1*), 84 (*45*), 85 (*60*), 86 (*200*), 87 (*22*), 97 (*1*) 106 (*210*), 107 (*50*), 112 (*1*), 114 (*130*), 132 (*60*), 148 [i (*23*)].—**60°–66° 30′** S.: 228 (*4*) 230 (*2*),—**66° 30′–76°** S.: 172 (*2*).—**76°–78°** S.: 317 [19 (*1*), 29 (*1*), 31 (*1*)].

182. *Oncæa dentipes*, Giesbr.

Oncæa dentipes, Giesbrecht, 1892.

Occurrence.—One specimen off New Zealand in a vertical haul 0–100 metres.

Remarks.—Length, ♀, 0·52 mm. Though the furca was missing and the small size of the single specimen did not allow of a satisfactory examination of the appendages, the proportional lengths of the cephalothorax and abdominal segments (75, 24, 4, 4, 6) and the acute postero-lateral corners of the fourth thoracic segment are satisfactory characters by which it can be identified.

Record.—**30°–40°** S.: 82 (*1*).

183. *Oncæa subtilis*, Giesbrecht.

Oncæa subtilis, Giesbrecht, 1892.

Occurrence.—Taken once in the North Atlantic.

Record.—North Temp. Atlantic: 14 (*1*).

184. *Oncæa curvata*, Giesbrecht.

Oncæa curvata, Giesbrecht, 1902.

Occurrence.—Frequent in the Antarctic, especially under the ice at Winter Quarters, and extending northwards as far as 58° 30′ N.

Records.—**50°–60°** S.: 197a (*24*).—**60°–66° 30′** S.: 215 (*10*), 216 (*20*).—**66° 30′–76°** S.: 281 (*1*).—**76°–78°** S.: 315 (*52*), 317 [4 (*11*), 5 (*7*), 6 (*4*), 7 (*16*), 9 (*10*), 10 (*1320*), 15 (*85*), 17 (*11*), 18 (*6*), 19 (*170*), 21 (*11*), 22 (*60*), 23 (*120*), 24 (*25*), 29 (*33*), 30 (*60*), 31 (*30*), 37 (*10*), 38 (*26*)], 318 (*10*), 323 [39 (*10*)], 325 (*132*), 345 (*27*), 346 (*2*), 347 (*1*), 351 [57 (*1300*), 58 (*132*), 59 (*32*), 60 (*70*), 64 (*4*), 65 (*1*)], 352 (*170*).

185. *Lubbockia*, sp.

An immature specimen of *Lubbockia* was taken in the Antarctic in a vertical haul from 1750 metres. It was apparently in stage V, the number of the abdominal segments being four; total length 1·74 mm., cephalothorax 0·9 mm., abdomen 0·84 mm., proportional lengths of abdominal segments and furca 17, 30, 24, 28, 15, second basal joint of maxilliped with three spines, two on the proximal third and one at the commencement of the distal third, first basal joint with a blunt spine.

As only the adult of *L. aculeata* is known it is not possible to say whether the specimen belongs to it or to a new species. It is too large for *L. squillimana*.

Record.—**66° 30′–76°** S.: 276 (*1*).

186. *Sapphirina ovatolanceolata*, Dana.

Sapphirina ovatolanceolata, Giesbrecht, 1892.

Occurrence.—Off New Zealand, scarce. One specimen in the North Atlantic.
Remarks.—Length, ♀, 2·82 mm., ♂, 3·42–3·60 mm.
Records.—North Temp. Atlantic : 11 (*1*).—30°–40° S. : 86 (*1*), 114 (*2*), 130 (*1*).

187. *Sapphirina gemma*, Dana.

Sapphirina gemma, Giesbrecht, 1892.

Occurrence.—One specimen off New Zealand, a ♂, length 3·72 mm.
Record.—30°–40° S. : 83 (*1*).

188. *Sapphirina salpæ*, Claus.

Sapphirina salpæ, Giesbrecht, 1892.

Occurrence.—Frequent off New Zealand.
Remarks.—Length, ♀, 6·22–6·84 mm., ♂, 6·6 mm. Two of the specimens on Station 138 appeared to be the same as *S. longifurca*. A. Scott (1909), and others were seen which approached it in the form of the furcal rami. It should, I think, be regarded as a variation of the typical *S. salpæ*.
Records.—South Temp. Atlantic : 311 (*2*).—30°–40° S. : 103 (*3*), 106 (*1*), 126 (*4*), 129 (*4*), 130 (*9*), 138 (*7*), 139 (*14*), 141 (*9*), 143 (*1*).

189. *Sapphirina sali*, n. sp. Fig. 34.
Description.—Female, length 2·4–2·75 mm. Body (fig. 34 *a*) moderately slender, its greatest width, at the posterior margin of the cephalon, being a little less than one-third of the total length, eyes small and inconspicuous, fourth thoracic segment much narrower than the third, abdomen slightly more than half the length of the cephalothorax. Furcal rami (fig. 34 *b*) narrow, more than three times as long as wide, with a small blunt tooth distally on the inner margin, median dorsal seta situated at the beginning of the distal third of the furca as in *S. salpæ*.

Appendages of the same type as in *S. pyrosomatis*. Antennules (fig. 34 *c*) more than three-quarters of the length of the antennæ, joints of the antennules measuring, in 0·01 mm., 8, 21, 6, 4, 6. Antennæ (fig. 34 *d*) with second joint more than twice as long as the first, third and fourth joints together about two-thirds as long as second, and ending in a single claw. Fourth feet (fig. 34 *e*) with well-developed endopodite almost as long as the exopodite, exopodite with two outer-edge setæ on the third joint. Fifth feet large and sausage shaped, reaching beyond the middle of the genital segment and with two terminal setæ of which the longer is as long as the free joint.

Occurrence.—In small numbers on nine stations off new Zealand, surface to 3 metres.

Remarks.—This species has a furca resembling that of *S. salpœ* and in general appearance, except for the large fifth feet, is not unlike a diminutive form of that species,

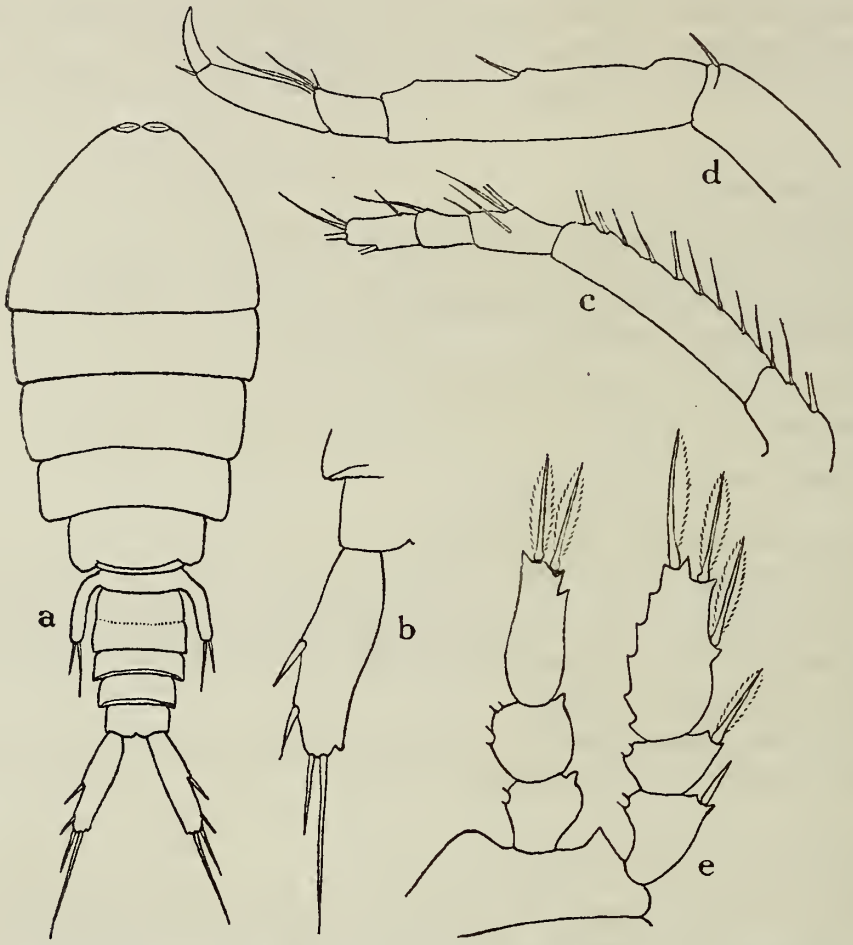

Fig. 34.—*Sapphirina sali*, n. sp. Female: *a*, dorsal view, × 37; *b*, ramus of furca, × 74; *c*, antennule, × 153; *d*, antenna, × 153; *e*, fourth foot.

but in the structure of its appendages it approaches more nearly to *S. pyrosomatis*. Three of the females were ovigerous.

Records.—**30°–40°** S.: 85 (*2*), 100 (*1*), 107 (*3*), 109 (*3*), 110 (*4*), 120 (*4*), 127 (*1*), 128 (*1*), 139 (*3*).

190. *Sapphirina angusta*, Dana.

Sapphirina angusta, Giesbrecht, 1892.

Occurrence.—Frequent off New Zealand.

Remarks.—Length, ♀, 3·24–3·65 mm., ♂, 4·8–5·1 mm.

Records.—**30°–40°** S.: 72 (*1*), 83 (*1*), 84 (*1*), 85 (*4*), 92 (*1*), 93 (*1*), 106 (*2*), 107 (*1*), 109 (*4*), 114 (*2*), 118 (*2*), 122 (*1*), 127 (*3*), 129 (*1*), 130 (*1*), 131 (*1*), 139 (*26*), 143 (*18*).

191. *Sapphirina vorax*, Giesbrecht.

Sapphirina vorax, Giesbrecht, 1892.

Occurrence.—Two specimens, males, length 1·83 mm., off New Zealand.
Records.—30°–40° S.: 83 (*1*), 86 (*1*).

192. *Sapphirina pyrosomatis*, Giesbrecht.

Sapphirina pyrosomatis, Giesbrecht, 1892.

Occurrence.—Taken twice in the North Atlantic in 23° 28′ N.
Records.—Trop. Atlantic: 64 (*2*), 65 (*2*).

193. *Sapphirina auronitens*, Claus.

Sapphirina auronitens, Giesbrecht, 1892.

Occurrence.—Occurred a few times both in the Tropical Atlantic and off New Zealand.
Remarks.—Length, ♀, 1·92–2·82 mm., ♂, 1·98 mm.
Records.—Trop. Atlantic: 62 (*1*), 64 (*1*).—30°–40° S.: 83 (*1*), 85 (*1*), 89 (*1*), 114 (*1*), 131 (*1*), 133 (*1*).

194. *Sapphirina scarlata*, Giesbrecht.

Sapphirina scarlata, Giesbrecht, 1892.

Occurrence.—A few specimens were taken off New Zealand and as far south as the Auckland Islands.
Remarks.—Length, ♀, 2·55–3·6 mm., ♂, 2·7 mm. The lengths of the joints of the antennules show some variation and do not furnish a satisfactory character.—The great width of the second thoracic segment as compared with the third is a more definite feature by which it can be distinguished from *S. nigromaculata*.
Records.—30°–40° S.: 84 (*2*), 109 (*1*), 114 (*5*), 126 (*1*).—50°–60° S.: 235 (*1*), 238 (*3*).

195. *Sapphirina nigromaculata*. Claus.

Sapphirina nigromaculata, Giesbrecht, 1892.

Occurrence.—On three Atlantic stations off South America, one in 18° S. and two off Rio de Janeiro.
Remarks.—Length, ♀, 1·8–1·9 mm., ♂, 1·68 mm.
Records.—Trop. Atlantic: 39 (*12*), 40 (*4*), 50 (*6*).

196. *Sapphirina bicuspidata*, Giesbrecht.

Sapphirina bicuspidata, Giesbrecht, 1892.

Occurrence.—One specimen, a male, length 2·07 mm., in the Atlantic in 4° 50′ N.
Record.—Trop. Atlantic: 62 (*1*).

197. *Sapphirina intestinata*, Giesbrecht.

Sapphirina intestinata, Giesbrecht, 1892.

Occurrence.—Taken once off New Zealand.
Remarks.—Length, ♀, 1·8 mm.
Record.—**30°–40°** S.: 85 (*4*).

198. *Sapphirina maculosa*, Giesbrecht.

Sapphirina maculosa, Giesbrecht, 1892.

Occurrence.—One female, length 2·34 mm., was taken off New Zealand.
Record.—**30°–40°** S.: 93 (*1*).

199. *Sapphirina opalina*, Dana.

Sapphirina opalina, Giesbrecht, 1892.

Occurrence.—Taken on three stations off Rio de Janeiro and on several stations off New Zealand.
Remarks.—Length, ♀, 2·35–2·45 mm., ♂, 2·45–2·64 mm. (Atlantic specimens), ♀, 2·94–3·9 mm., ♂, 2·55–3·9 mm. (New Zealand specimens).
Records.—Trop. Atlantic: 39 (*18*), 40 (*3*), 43 (*1*).—**30°–40°** S.: 84 (*1*), 86 (*11*), 93 (*2*), 109 (*1*), 114 (*1*), 120 (*2*), 126 (*2*), 130 (*1*), 132 (*2*).

200. *Sapphirina metallina*, Dana.

Sapphirina metallina, Giesbrecht, 1892.

Occurrence.—One female, length 2·22 mm., was taken off New Zealand.
Record.—**30°–40°** S.: 127 (*1*).

201. *Copilia vitrea* (Haeckel).

Copilia vitrea, Lehnhofer, 1926.

Occurrence.—Frequent off New Zealand.
Records.—**30°–40°** S.: 83 (*2*), 85 (*2*), 89 (*1*), 92 (*6*), 93 (*4*), 109 (*1*), 126 (*1*), 129 (*2*), 131 (*4*).

202. *Copilia mirabilis*, Dana.

Copilia mirabilis, Lehnhofer, 1926.

Occurrence.—Only taken in the Tropical Atlantic where it was common.
Records.—Trop. Atlantic: 39 (*5*), 40 (*2*), 43 (*9*), 50 (*27*), 58 (*1*), 59 (*1*), 63 (*3*).

203. *Copilia Hendorffi*, Dahl.

Copilia Hendorffi, Lehnhofer, 1926.

Occurrence.—Common off New Zealand.

Remarks.—Taking into consideration the records given by Lehnhofer (1926) this species seems to have a continuous distribution from New Zealand by way of Australia to South Africa, where it was taken plentifully in the Benguela Current by the "Valdivia."

Records.—**30°–40°** S.: 85 (*1*), 87 (*3*), 89 (*1*), 92 (*4*), 93 (*7*), 109 (*10*), 112 (*9*), 114 (*5*), 120 (*7*), 126 (*6*), 130 (*1*), 131 (*14*), 132 (*20*), 133 (*4*), 136 (*4*).

204. *Copilia quadrata*, Dana.

Copilia quadrata, Lehnhofer, 1926.

Occurrence.—Taken once in the North Atlantic and once off New Zealand.

Records.—North Temp. Atlantic: 9 (*1*).—**30°–40°** S.: 133 (*1*).

205. *Copilia lata*, Giesbrecht.

Copilia lata, Lehnhofer, 1926.

Occurrence.—Only taken in the Tropical Atlantic where it was scarce.

Records.—Tropical Atlantic: 43 (*1*), 50 (*5*), 64 (*1*), 92 (*1*).

206. *Corycæus speciosus*, Dana.

Corycæus speciosus, M. Dahl, 1912.

Occurrence.—Common in the Atlantic south of 27° 22′ N., but scarce off New Zealand.

Records.—North Temp. Atlantic: 66 (*7*), 67 (*9*), 68 (*2*).—Trop. Atlantic: 39 (*7*), 40 (*4*), 43 (*100*), 50 (*990*), 52 (*320*), 56 (*13*), 57 (*80*), 58 (*49*), 59 (*120*), 61 (*20*), 62 (*110*), 63 (*100*).—South Temp. Atlantic: 310 (*1*).—**30°–40°** S.: 78 (*1*), 114 (*3*), 128 (*1*).

207. *Corycæus Clausi*, F. Dahl. Fig. 35.

Corycæus ovalis, Giesbrecht, 1892; *Corycæus Clausi*, M. Dahl, 1912.

Occurrence.—On two stations in the North Temperate and two in the Tropical Atlantic, scarce.

Remarks.—Length, ♀, 1·5–1·74 mm., ♂, 1·44 mm. I have followed M. Dahl in including *C. ovalis* of Giesbrecht in the synonomy of this species. The females from Station 50, off South America (fig. 35), are smaller (1·5–1·55 mm.) and more slender than the others and show some resemblance in the form of the body to *C. crassiusculus* as figured by M. Dahl.

Records.—North Temp. Atlantic: 9 (*3*), 68 (*1*).—Trop. Atlantic: 50 (*5*), 64 (*1*).

208. *Corycæus crassiusculus*, Dana. Fig. 36.

Corycæus Danæ, Giesbrecht, 1892; *Corycæus crassiusculus*, M. Dahl, 1912.

Occurrence.—Common off New Zealand.

Remarks.—Length, ♀, 1·74 mm., ♂, 1·5 mm. The New Zealand specimens (fig. 36) have not so slender an abdomen as those figured either by Giesbrecht or M. Dahl and in

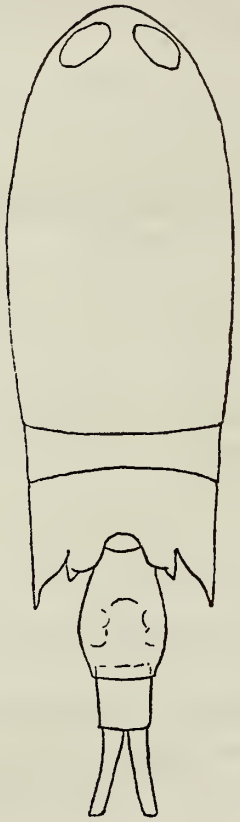

Fig. 35.—*Corycæus Clausi.* Female, specimen from Stn. 50, dorsal view, × 50.

Fig. 36.—*Corycæus crassiusculus.* Female, New Zealand specimen: *a*, dorsal view, × 89; *b*, abdomen, lateral view, × 89.

that respect are intermediate between *C. Clausi* and *C. crassiusculus.* The differences between the two species are not very clearly marked.

Records.—**30°–40°** S.: 71 (*4*), 75 (*1*), 78 (*3*), 81 (*8*), 82 (*2*), 83 (*5*), 84 (*8*), 85 (*24*), 86 (*110*), 87 (*14*), 93 (*4*), 97 (*14*), 100 (*1*), 107 (*1*), 109 (*1*), 112 (*5*), 114 (*70*), 120 (*390*), 137 (*3*), 146 (*5*), 203 (*1*).

209. *Corycæus typicus*, Kröyer.

Corycæus alatus, Giesbrecht, 1892; *Corycæus typicus*, M. Dahl, 1912.

Occurrence.—Taken a few times in the North Temperate and, on its northern limits, the Tropical Atlantic and in the South Atlantic once plentifully in 18° S.

Remarks.—Length, ♀, 1·37 mm. I have in this and other cases used the names

given in M. Dahl's monograph of the genus, although the advisability of reviving some of the earlier names seems to me to be questionable.

Records.—North Temp. Atlantic : 60 (*1*), 67 (*10*), 68 (*35*).—Trop. Atlantic : 50 (*65*), 64 (*1*), 65 (*1*).

210. *Corycæus flaccus*, Giesbrecht.

Corycæus flaccus, M. Dahl, 1912.

Occurrence.—Taken a few times in the North Temperate and near the northern and southern limits of the Tropical Atlantic and common off New Zealand. A male apparently belonging to this species was taken in the Antarctic in a deep vertical haul 0–1000 metres.

Remarks.—Length, ♀, 1·66–1·70 mm. (Trop. Atlantic), 1·8–1·85 mm. (New Zealand) ; ♂, 1·38–1·15 mm. (Trop. Atlantic, 1·55–1·68 mm. (New Zealand). Males were, throughout, much more numerous than females.

Records.—North Temp. Atlantic : 8 (*1*), 18 (*10*), 19 (*1*), 66 (*35*), 67 (*16*), 68 (*14*).—Trop. Atlantic : 43 (*1*), 50 (*5*), 64 (*6*), 65 (*8*).—**30°–40°** S. : 76 (*2*), 78 (*6*), 79 (*1*), 81 (*25*), 83 (*10*), 84 (*9*), 85 (*12*), 86 (*290*), 87 (*30*), 97 (*1*), 100 (*2*), 106 (*20*), 109 (*2*), 112 (*12*), 113 (*3*), 114 (*200*), 119 (*4*), 120 (*395*), 127 (*8*), 128 (*3*), 140 (*3*), 146 (*6*).—**66° 30′–76°** S. : 282 (*1*).

211. *Corycæus limbatus*, Brady.

Corycæus limbatus, M. Dahl, 1912.

Occurrence.—Very much scarcer than either *C. typicus* or *C. flaccus*. Only three females were taken, on three stations off New Zealand. It is possible that males may have been overlooked on other stations.

Remarks.—Length, ♀, 1·45 mm.

Records.—**30°–40°** S. : 75 (*1*), 86 (*1*), 87 (*1*).

212. *Corycæus longistylis*, Dana.

Corycæus longistylis, Giesbrecht, 1892 ; *Corycæus longistylis*, M. Dahl, 1912.

Occurrence.—Not taken except off New Zealand, where it was not uncommon. This agrees with M. Dahl's conclusion that it is absent from the Atlantic.

Remarks.—Length, ♀, 2·76–2·88 mm., ♂, 2·28–2·4 mm.

Records.—**30°–40°** S. : 76 (*1*), 79 (*2*), 87 (*1*), 89 (*1*), 92 (*2*), 93 (*8*), 106 (*1*), 112 (*2*), 114 (*5*), 120 (*1*), 126 (*3*), 129 (*3*), 137 (*3*).

213. *Corycæus lautus*, Dana.

Corycæus lautus, M. Dahl, 1912.

Occurrence.—In small numbers in the Atlantic and off New Zealand.

Remarks.—Length, ♀, 2·85 mm., ♂, 2·3 mm. (North Temp. Atlantic) ; ♀, 2·94 mm., ♂, 2·5 (New Zealand).

Records.—North Temp. Atlantic: 9 (*3*), 66 (*3*), 67 (*1*), 68 (*4*).—Trop. Atlantic: 50 (*30*).—**30°–40°** S.: 83 (*3*), 85 (*4*), 87 (*1*), 93 (*4*), 114 (*5*), 120 (*1*), 137 (*1*).

214. *Corycæus furcifer*, Claus.

Corycæus furcifer, Giesbrecht, 1892; *Corycæus furcifer*, M. Dahl, 1912.

Occurrence.—Frequent off New Zealand. Also taken within the Arctic Circle in two hauls, one at 10 metres the other a vertical haul from 1000 metres.

Remarks.—Length, ♀, 1·8–2·04 mm., ♂, 1·25–1·32 mm.

Records.—**30°–40°** S.: 75 (*2*), 81 (*1*), 85 (*6*), 87 (*54*), 97 (*2*), 100 (*2*), 101 (*1*), 106 (*1*), 112 (*10*), 114 (*4*), 120 (*6*), 128 (*1*), 146 (*1*).—**66° 30′–76°** S.: 282 (*2*), 286 (*1*).

215. *Corycæus inuncus*, n. sp. Fig. 37.

Description.—Female, length 1·17–1·23 mm. Cephalothorax, abdominal segments and furca (fig. 37 *a*) in the proportion 70, 19, 10, 20. Fourth thoracic segment slightly

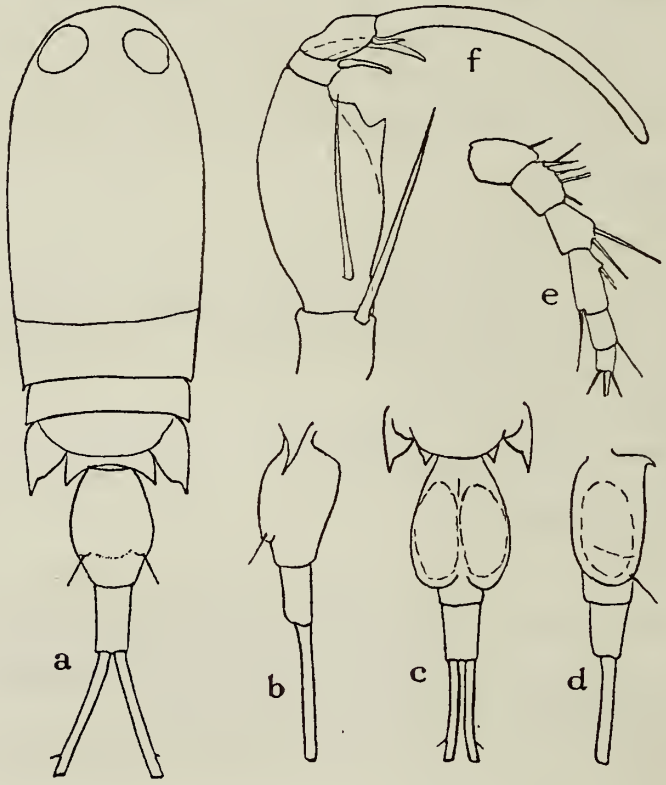

Fig. 37.—*Corycæus inuncus*, n. sp. Female: *a*, dorsal view, × 85; *b*, abdomen, lateral view, × 85. Male: *c*, abdomen, dorsal view, × 85; *d*, abdomen, lateral view, × 85; *e*, antennule; *f*, antenna.

expanded laterally and reaching back to the anterior third of the genital segment, the lateral prolongations having a distinct notch on their inner margins. Fifth thoracic segment ending in short sharp lateral spines. Genital segment (fig. 37 *b*) without an

antero-ventral hook, instead of which there is a slight chitinous projection. The antero-ventral angle of the genital segment is obtuse. Genital openings, at the posterior third of the segment, provided with a seta on each side. Furcal rami normally divergent, about as long as the genital segment.

Cephalic appendages and swimming feet similar to those of *C. tenuis* as described by M. Dahl (1912), the terminal spine of the exopodite of the second foot being curved outwards and the endopodite of the fourth foot having two well-developed setæ.

Male, length 0·96–1·05 mm., resembling that of *C. Lubbocki* as described by M. Dahl, but the spines of the fourth thoracic segment are shorter (fig. 37 *c*) and the antennæ (fig. 37 *f*) have shorter spines on the first and second joints and the tooth on the inner margin of the second joint is not as acute. The cephalothorax, abdominal segments and furca are in the proportion 55, 20, 7, 14 and the genital segment has a well-developed ventral hook (fig. 37 *d*).

Occurrence.—Common off New Zealand both in the open sea and in the Bay of Islands where it was very plentiful. Three specimens were found in a vertical haul (0–350 metres) from the Antarctic, but the record must be looked on with suspicion.

Remarks.—The female of this species resembles *C. tenuis* as described by M. Dahl (1912) in having long furcal rami and in the absence of a ventral hook on the genital segment. It differs in its larger size, in the more rounded antero-ventral margin of the genital segment, as in Giesbrecht's (1892) description of *C. tenuis*, in the shorter lateral spines of the fourth thoracic segment with a marked notch on the inner margin and in the more divergent furcal rami.

A few specimens had the prolongations of the fourth thoracic segment longer and more slender than in the specimen here figured, thus resembling *C. tenuis* more nearly, but there seem to be reasonable grounds for regarding *C. inuncus* as a new species rather than as a variety of *C. tenuis*.

Records.—**30°–40°** S. : 71 (*3*), 72 (*1*), 73 (*4*), 74 (*1*), 75 (*9*), 76 (*205*), 77 (*2*), 78 (*10*), 79 (*2*), 83 (*4*), 84 (*5*), 86 (*80*), 87 (*6*), 94 (*94*), 97 (*17*), 100 (*4*), 101 (*100*), 104 (*3*), 105 (*1*), 107 (*1*), 108 (*40*), 127 (*1*), 132 (*1400*), 138 (*5*), 140 (*7*), 146 (*150*), 147 (*49*), 148 [a (*1200*), b (*850*), c (*225*), d (*16*), e (*480*), f (*220*), g (*10*), h (*38*), i (*205*)], 203 (*6*).—**40°–50°** S. : 201 (*3*), 303 (*1*).—**76°–78°** : 342 (*3*).

216. *Corycæus Giesbrechti*, F. Dahl.

Corycæus venustus, Giesbrecht, 1892 ; *Corycæus Giesbrechti*, M. Dahl, 1912.

Occurrence.—Widespread in the Atlantic, but very scarce except on three stations off Rio de Janeiro where it was abundant.

Remarks.—Length, ♀, 0·88–0·95 mm. (North Temp. Atlantic) ; 0·93–1·02 mm. (Trop. Atlantic) ; ♂, 0·82–0·87 mm. (North Temp. Atlantic).

Records.—North Temp. Atlantic : 8 (*1*), 9 (*1*), 11 (*1*), 68 (*3*).—Trop. Atlantic : 25 (*2*), 39 (*7400*), 40 (*1420*), 43 (*70*), 53 (*1*), 56 (*2*), 57 (*1*), 59 (*1*).—South Temp. Atlantic : 310 (*1*).

217. *Corycæus latus*, Dana.

Corycæus latus, M. Dahl, 1912.

Occurrence.—Common in the Tropical Atlantic and taken once, one specimen, in the North Temperate Atlantic in 27° 22′ N. This distribution supports M. Dahl's conclusion that it is confined to the Atlantic, mainly to the tropical regions.

Remarks.—Length, ♀, 1·0–1·17 mm.

Records.—North Temp. Atlantic : 68 (*1*).—Trop. Atlantic : 43 (*8*), 50 (*126*), 52 (*78*), 53 (*20*), 56 (*27*), 57 (*80*), 58 (*3*), 59 (*5*), 61 (*2*), 62 (*9*), 63 (*13*), 64 (*10*), 65 (*5*).

218. *Corycæus ovalis*, Claus.

Corycæus obtusus, Giesbrecht, 1892 ; *Corycæus ovalis*, M. Dahl, 1912.

Occurrence.—Two specimens, females, in the North Atlantic just south of Madeira.

Remarks.—Length, ♀, 1·02 mm. Only known previously from the Mediterranean and from off the south coast of Portugal (Candeias, 1926). The present extension of its range was to be expected.

Record.—North Temp. Atlantic : 10 (*2*).

219. *Corycæus amazonicus*, F. Dahl.

Corycæus amazonicus, M. Dahl, 1912.

Occurrence.—Common off Rio de Janeiro but not taken elsewhere.

Remarks.—Length, ♀, 1·02 mm. The female of this species is easily recognised under a low magnification by the form of the genital segment which in lateral view is as wide as it is long and shorter than the anal segment.

Records.—Trop. Atlantic : 39 (*40*), 40 (*50*), 43 (*1*).

220. *Corycella gracilis* (Dana).

Corycæus gracilis, M. Dahl, 1912.

Occurrence.—Common in the Tropical Atlantic. It also occurred in the North Temperate Atlantic, south of 30° N., but in much smaller numbers. Outside the Atlantic a male which appeared to belong to this species was taken south of New Zealand in 49° 40′ S. and a female in the Antarctic in a vertical haul from 450 metres, but both these records are so discordant with what is known of its distribution that they should not be accepted without confirmation.

Remarks.—Length, ♀, 0·9–0·96 mm. (Tropical Atlantic) ; 0·79 mm. (North Temp. Atlantic) ; ♂, 0·8°–0·96 mm. (Tropical Atlantic) ; 0·66–0·75 mm. (North Temp. Atlantic). The female from the Antarctic measured 0·99 mm.

Records.—North Temp. Atlantic : 13 (*8*), 14 (*1*), 18 (*5*), 19 (*3*), 66 (*2*), 68 (*4*).—Trop. Atlantic : 23 (*18*), 25 (*69*), 39 (*14*), 40 (*2*), 43 (*30*), 50 (*144*), 52 (*25*), 53 (*10*), 56 (*3*), 57 (*4*), 58 (*2*), 61 (*6*), 62 (*90*), 63 (*30*), 65 (*4*).—**40°–50°** S. : 208 (*? 1*).—**76°–78°** S. : 346 (*? 1*).

221. *Corycella rostrata* (Claus).

Corycæus rostratus, Giesbrecht, 1892 ; *Corycæus rostratus*, M. Dahl, 1912.

Occurrence.—Occurred in the North Temperate, Tropical and South Temperate Atlantic, but was scarce throughout. Common off New Zealand, this being an extension of its previously known Atlantic and Mediterranean range.

Remarks.—Length, ♀, 0·78–0·80 mm., ♂, 0·66–0·70 mm. The New Zealand specimens agreed with those from the Atlantic, having the furca about twice as long as broad and a quarter of the total length of the abdomen and the genital openings on a line with the tips of the thoracic points.

Records.—North Temp. Atlantic : 4 (*1*), 8 (*3*), 9 (*1*), 10 (*50*), 11 (*7*), 13 (*4*).—Trop. Atlantic : 23 (*1*), 25 (*2*), 26 (*2*), 64 (*1*).—South Temp. Atlantic : 311 (*1*).—**30°–40°** S. : 71 (*48*), 73 (*65*), 74 (*8*), 76 (*205*), 77 (*42*), 78 (*25*), 79 (*1*), 82 (*35*), 84 (*3*), 85 (*1*), 92 (*2*), 105 (*6*), 114 (*1*), 116 (*1*), 119 (*14*), 128 (*1920*), 140 (*1*), 148 [e (*2*)], 203 (*36*).—**40°–50°** S. : 201 (*2*).

222. *Microsetella rosea* (Dana).

Microsetella rosea, Giesbrecht, 1892.

Occurrence.—Taken once in the Tropical Atlantic and a few times off New Zealand.

Remarks.—Length, ♀, 0·57 mm. (Trop. Atlantic) ; 0·84–0·9 mm. (New Zealand).

Records.—Trop. Atlantic : 87 (*1*).—**30°–40°** S. : 73 (*1*), 74 (*140*), 77 (*12*), 108 (*1*), 117 (*2*), 128 (*1*), 148 [c (*16*)].—**40°–50°** S. : 201 (*1*).

223. *Microsetella norvegica* (Boeck).

Microsetella atlantica, Giesbrecht, 1892.

Occurrence.—Owing to its small size this species was very rarely taken and the records cannot be expected to give a true picture of its distribution. It was taken in the North Atlantic and from New Zealand to near the Antarctic Circle.

Remarks.—Length, ♀, 0·48 mm. (North Temp. Atlantic), 0·36–0·40 mm. (New Zealand).

Records.—North Temp. Atlantic : 10 (*27*).—**40°–50°** S. : 201 (*30*),—**50°–60°** S. : 197 (*1*).—**60°–66° 30′** S. : 228 (*1*).

224. *Euterpe acutifrons* (Dana).

Euterpe acutifrons, Giesbrecht, 1892.

Occurrence.—Taken twice in the North Temperate Atlantic. Scarce off New Zealand except in the littoral waters of the Bay of Islands, where it was frequent.

Records.—North Temp. Atlantic : 8 (*2*), 10 (*1*).—**30°–40°** S. : 77 (*1*), 97 (*2*), 147 (*1*), 148 [a (*1*), c (*20*), d (*8*), e (*3*), f (*20*), i (*25*)], 283 (*7*).—**40°–50°** S. : 201 (*1*).

225. *Setella gracilis*, Dana.

Setella gracilis, Giesbrecht, 1892.

Occurrence.—Taken in small numbers in the Tropical Atlantic and off New Zealand; common on one station off Three Kings Island, New Zealand.

Records.—Trop. Atlantic: 43 (*2*), 54 (*4*), 56 (*1*), 57 (*2*), 59 (*1*), 63 (*1*).—**30°–40°** S.: 77 (*1*), 117 (*1*), 119 (*6*), 128 (*80*), 147 (*1*).

226. *Miracia efferata*, Dana.

Miracia efferata, Giesbrecht, 1892.

Occurrence.—Common in the Tropical Atlantic and on two sub-tropical North Temperate stations.—Outside the Atlantic one specimen was taken on a station about 140 miles N.W. of New Zealand.

Records.—North Temp. Atlantic: 66 (*7*), 67 (*2*).—Trop. Atlantic: 50 (*15*), 52 (*218*), 53 (*80*), 56 (*70*), 57 (*70*), 58 (*50*), 59 (*250*), 61 (*18*), 62 (*5*), 63 (*260*), 64 (*2*), 65 (*9*).—**30°–40°** S.: 114 (*1*).

227. *Clytemnestra scutellata*, Dana.

Clytemnestra scutellata, Giesbrecht, 1892.

Occurrence.—Taken once in the North Atlantic, off Portugal, and once off New Zealand.

Records.—North Temp. Atlantic: 4 (*1*).—**30°–40°** S.: 140 (*1*).

228. *Harpacticus furcifer*, Giesbrecht.

Harpacticus furcifer, Giesbrecht, 1902.

Occurrence.—A large number of males of this Antarctic species were taken under the ice on one station off Cape Evans in company with *Paralabidocera antarctica*, and two females in a haul at 10 metres in Terra Nova Bay off Drygalski Glacier, also with *P. antarctica*. Giesbrecht's specimens were taken in a hollow in pack ice in 70° S. south of S. America.

Records.—**66° 30′–76°** S.: 221 (*2*).—**76°–78°** S.: 323 [54 (*60*)].

229. *Idya tenuimana*, Giesbrecht.

Idya tenuimana, Giesbrecht, 1902.

Occurrence.—One specimen was taken in a haul under the ice at Cape Evans.

Remarks.—Length, ♀, 1·12 mm. This is somewhat larger than the size given by Giesbrecht, viz. 0·85 mm., and as the 5th feet were missing the identification cannot be regarded as quite certain. Some other small points of difference were noted. The second joint of the endopodite of the 1st foot is about $1\frac{1}{4}$ times as long as the first joint

instead of $1\frac{1}{6}$ times, the first joint of the endopodite is proportionately a little broader and the outer and inner spines of the second basal joint are a little longer. The maxillipede, which Giesbrecht mentions as the outstanding character of *I. tenuimana*, is similar to Giesbrecht's figure.

Record.—**76°–78°** S. : 317 [29 (*1*)].

230. *Idya racovitzai*, Giesbrecht.

Idya racovitzai, Giesbrecht, 1892.

Occurrence.—Five specimens were taken in 64° S. in two hauls, one at the surface the other at 80 metres.

Remarks.—Length, ♀, 0·54–0·66 mm., ♂, 0·48.

Records.—**60°–66° 30′** S. : 228 (*2*), 230 (*3*).

231. *Idya furcata* (Baird).

Idya furcata, G. O. Sars, 1911.

Occurrence.—Taken in small numbers on several stations in the Bay of Islands.

Remarks.—Length, ♀, 0·78–0·92 mm. These specimens were smaller than the average size of *I. furcata*, but as the appendages agreed closely with those of the North Atlantic species I record them under that name. Brady (1899) has already recorded *I. furcata* from New Zealand.

Records.—**30°–40°** S. : 148 [d (*10*), e (*5*), f (*1*), h (*3*), i (*1*)].

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INDEX.

The more important references are indicated by black type.

ABDOMINALE, Pleuromma, 259.
abdominalis, Pleuromamma, **259.**
abyssalis, Heterorhabdus, 266.
———— Spinocalanus, **227.**
Acartia, 279, **281.**
Acrocalanus, **222.**
aculeata, Lubbockia, 286.
aculeatus, Arietellus, **270.**
,, Paracalanus, **222.**
acus, Eucalanus, 212, **218.**
acuta, Euchæta, **237, 238.**
,, Scolecithrix, 254.
acutifrons, Euterpe, **297.**
,, Haloptilus, **267,** 268.
,, Labidocera, **274.**
acutus, Ætideus, 211, **228.**
,, Calanus, 214, **216.**
æstiva, Labidocera, 277.
æthiopica, Candacia, 271, **272.**
Ætideopsis, **230.**
Ætideus, **228.**
affinis, Gaidius, 232.
,, Pareuchæta, 241.
,, Scaphocalanus, **248.**
alatus, Corycæus, **292.**
Alloiorhabdus, 266, 267.
altera, Amallophora, **252,** 253.
Amallophora, 248, **252.**
amazonicus, Corycæus, 211, **296.**
americana, Calanopia, 211, **274.**
angusta, Sapphirina, **288.**
antarctica, Euchæta, 238.
,, Farœlla, 230.
,, Paracartia, 280.
,, Paralabidocera, **280,** 298.
,, Pareuchæta, **238,** 239.
antarcticus, Augaptilus, 269.
,, Chiridius, **230,** 231.
,, Gætanus, **233.**
,, Racovitzanus, **250.**
,, Spinocalanus, 227.
arcuicornis, Clausocalanus, **223,** 225.
Arietellus, **269.**
armatus, Ætideus, **228.**
,, Arietellus, 270.
atlantica, Lucicutia, 264
,, Microsetella, 297.
,, Ratania, **283.**
attenuatus, Eucalanus, **218,** 219.
aucklandicus, Centropages, **256.**
Augaptilus, **269.**
Aurivillii, Calanopia, **273.**
auronitens, Sapphirina, **289.**
austrinus, Alloiorhabdus, 266.
austrinus, Heterorhabdus, 211, **265,** 266.

barbata, Pareuchæta, 240, 241.
bicuspidata, Sapphirina, **289.**
biloba, Pareuchæta, 212, **242.**
bipinnata, Candacia, **272.**
bispinosa, Candacia, **272.**
borealis, Pleuromamma, 212, 260, 261, **262.**
Bradyi, Ætideus, 229.
,, Centropages, **255.**
,, Scolecithrix, **243.**
brasiliense, Labidocera, 211, **276,** 277.
brevicornis, Amallophora, 248.
,, Calanus, 215.
,, Heterorhabdus, 267.
,, Scaphocalanus, **248,** 249, 250.
brevis, Euchirella, **234.**
,, Monops, 280.
,, Pontellopsis, **280.**

Calanopia, **273.**
Calanus, **212.**
Calocalanus, **222.**
Candacia, **270.**
carinatus, Calanus, **215.**
Centropages, **255.**
Cephalophanes, **254.**
Cervi, Labidocera, 211, **275.**
cheirura, Candacia, 212, **273.**
Chiridius, **229.**
Chirundina, **234.**

Clausi, Acartia, **281.**
,, Corycæus, **291.**
,, Leuckartia, 263.
,, Lucicutia, **263.**
,, Mecynocera, **221.**
Clausocalanus, **223.**
Clytemnestra, **298.**
compactus, Heterorhabdus, **267.**
conifera, Oncæa, **285.**
contractus, Calocalanus, 223.
Copilia, **290.**
cornutus, Rhincalanus, **220.**
Corycæus, **291.**
Corycella, **296.**
crassiusculus, Corycæus, **291,** 292.
crassus, Eucalanus, 219, **220.**
Ctenocalanus, **226.**
curta, Candacia, **272.**
,, Lucicutia, **264.**
,, Scolecithrix, 250.
curticauda, Metridia, **259.**
curtus, Scaphocalanus, **250.**
curvata, Oncæa, **286,**

Danæ, Acartia, **282.**
,, Corycæus, 291.
,, Scolecithrix, **243.**
Darwini, Calanus, **217.**
dentata, Scolecithricella, **247.**
,, Scolecithrix, 247.
dentipes, Oncæa, **286.**
discaudatus, Centropages, 256, 257.
Drepanopsis, **232.**

echinatus, Scaphocalanus, 249, **250.**
,, Scolecithrix, 250.
efferata, Miracia, **298.**
elongatus, Eucalanus, **218.**
emarginata, Scolecithrix, 245.
ensifera, Acartia, 281.
Erebi, Pareuchæta, **239.**
Euaugaptilus, **269.**
Eucalanus, **218.**
Euchæta, **237.**
Euchirella, **234.**
Euterpe, **297.**

falcifera, Candacia, **270,** 271.
falcifer, Scolecithrix, 244.
Farœlla, **230.**
Farrania, 232.
Farrani, Euchæta, 240.
,, Pareuchæta, **240.**
filigerus, Augaptilus, 269.
filigerus, Euaugaptilus, **269.**
finmarchicus, Calanus, **212,** 213, 215.
flaccus, Corycæus, **293.**
flava, Ratania, 284.
flavicornis, Lucicutia, **262.**
frigida, Oithona, **283.**
frigidus, Cephalophanes, **254.**
,, Drepanopsis, **232.**
furcata, Idya, 212, **299.**
furcatus, Centropages, **255.**
,, Clausocalanus, **225.**
furcifer, Corycæus, **294.**
,, Harpacticus, **298.**

Gætanus, **233.**
Gaidius, **231.**
gemina, Lucicutia, **263.**
gemma, Sapphirina, **287.**
Gerlachei, Metridia, 216, **257.**
Giesprechti, Ætidius, **228,** 229.
,, Corycæus, **295.**
gigas, Rhincalanus, **220.**
glacialis, Scolecithricella, **247.**
,, Scolecithrix, 247.
gracilis, Calanus, **217.**
,, Chiridius, **229.**
,, Corycæus, 296.
,, Corycella, **296.**
,, Pleuromamma, **260,** 261, 262.
,, *var.* Esterleyi, Pleuromamma, 262.
,, Pleuromma, 260.
,, Stella, **298.**
,, Scaphocalanus, 248.
grandis, Lucicutia, **265.**
,, Rhincalanus, 220.

Haloptilus, **267.**
Harpacticus, **298.**
hecticus, Euaugaptilus, **269.**
Hecticus, Euaugaptilus, **269.**
helgolandicus, Calanus, 212, 213.
Hemicalanus, 268.
Hendorffi, Copilia, 211, **290.**
Heterorhabdus, **265.**
Heterostylites, **267.**
hirsuta, Euchirella, **237.**
Hodgsoni, Paralabidocera, 211, **280.**
horridus, Spinocalanus, 228.

Idya, 298.
impar, Amallophora, 249.
,, Scaphocalanus, 249, 250.
incisa, Scolecithrix, **244.**
intermedius, Gaidius, 231.
intestinata, Sapphirina, **290.**
inuncus, Corycæus, 211, 281, **294.**

Labidocera, 274.
laminata, Scolecithrix, 245.
lata, Copilia, **291.**
laticeps, Clausocalanus, 212, **224,** 225.
,, Euaugaptilus, **269.**
Latipes, Lophothrix, **254.**
Latirostris, Euchirella, 212, **234,** 235.
latus, Corycæus, **296.**
lautus, Corycæus, **293.**
limbatus, Corycæus, **293.**
Lobiancoi, Pontella, 279.
longicaudatus, Augaptilus, **269.**
longicornis, Acrocalanus, **222.**
,, Euchæta, **238.**
,, Haloptilus, **269.**
,, Heterostylites, **267.**
longifurca, Sapphirina, 287.
,, Scaphocalanus, 249.
,, Scolecithrix, 249.
longimana, Candacia, **270,** 271.
longipes, Stephus, **226.**
longistylis, Corycæus, **293.**
Lophothrix, **254.**
Lubbocki, Corycæus, 295.
Lubbockia, **286.**
lucens, Metridia, 212, **258.**
Lucicutia, **262.**

maculosa, Sapphirina, **290.**
magna, Lucicutia, **264.**
magnus, Spinocalanus, **227.**
major, Heterostylites, **267.**
,, Undeuchæta, **233.**
marina, Euchæta, **237.**
mayumbænsis, Temoropia, **257.**
Mecynocera, **221.**
media, Euchæta, 237, **238.**
,, Oncæa, **285.**
mediterranea, Oncæa, **285.**
medius, Alloiorhabdus, 267.
metallina, Sapphirina, **290.**
Metridia, **258.**
Microcalanus, **226.**
Microsetella, **297.**
minor, Calanus, **214,** 215.
,, Chiridius, **230.**
,, Gætanus, 233.
,, Scolecithricella, 225, **247.**
,, Undeuchæta, **233.**
mirabilis, Copilia, **290.**
Miracia, **298.**
modestus, Chiridius, 230, 231.
Monops, 280.
mucronatus, Eucalanus, **218.**
,, Haloptilus, **268.**
multiserratus, Chiridius, 231.

nasutus, Rhincalanus, **220,** 221.
negligens, Acartia, **281.**
Nerii, Labidocera, **275.**
nigromaculata, Sapphirina, **289.**
norvegica, Microsetella, **297.**
norvegicus, Heterorhabdus, 265, 266.
notacantha, Pseudochirella, **232.**
novæ-zealandiæ, Pontella, 211, **277.**

oblonga, Farrania, 232.
obtusifrons, Chiridius, 230.
obtusus, Corycæus, 296.
ocellatus, Haloptilus, **268.**
Oithona, **282.**
Oncæa, **284.**
opalina, Sapphirina, **290.**
ovalis, Corycæus, 291, **296.**
,, Lucicutia, 263.
ovata, Scolecithrix, 244, 245, **246.**
ovatolanceolata, Sapphirina, **287.**
oxycephalus, Haloptilus, **268.**

pachydactyla, Candacia, **272.**
papilliger, Heterorhabdus, **265.**
Paracalanus, **221.**
Paracartia, 280.
Para labidocera, **280.**
Pareuchæta, **238.**
parvus, Paracalanus, **221.**
patagoniensis, Calanus, 211, 215.
paululus, Clausocalanus, **224.**
pauper, Calanus, **215.**
pavo, Calocalanus, **222.**
pergens, Clausocalanus, 223, **224.**
persecans, Scottocalanus, **252.**
perspicax, Monops, 280.
,, Pontellopsis, **280.**
Phænna, **255.**
Piseki, Pleuromamma, 260, **261.**
Pleuromamma, **259.**
Pleuromma, 259.
plumata, Pontellina, **280.**
plumifera, Oithona, **282,** 283.
plumosa, Undeuchæta, 233.
,, Undina, 233.
plumulosus, Calocalanus, **223.**
polaris, Chiridius, **229.**
,, Scolecithrix, **243,** 245.
Pontella, **277.**
Pontellina, **280.**
Pontellopsis, **280.**
Poppei, Chiridius, **229.**
princeps, Metridia, **258.**
propinguus, Calanus, 213, **214,** 216, 217.

Pseudochirella, **232.**
pseudofrigida, Oithona, 283.
pubera, Euchæta, **238.**
pusillus, Microcalanus, 226.
pustutifera, Heterorhabdus, **266.**
pygmæus, Microcalanus, **226.**
pyrosomatis, Sapphirina, 287, 288, **289.**

quadrata, Copilia, **291.**

racovitzai, Idya, 212, **299.**
Racovitzanus, **250.**
rasa, Pareuchæta, **240.**
Ratania, **283.**
refulgens, Cephalophanes, 254.
regalis, Pontellopsis, **280.**
Rhincalanus, **220.**
robusta, Pleuromamma, 212, **260.**
,, Scolecithrix, **246.**
robustior, Calanus, **217.**
robustus, Heterorhabdus, 265, **266.**
rosea, Microsetella, **297.**
rostrata, Corycella, **297.**
,, Euchirella, **234,** 235, 236.
rostratus, Corycæus, 297.
rostromagna, Euchirella, 235, **236.**

sali, Sapphirina, 211, **287.**
salpæ, Sapphirina, **287.**
Sapphirina, **287.**
Scaphocalanus, **248.**
scarlata, Sapphirina, **289.**
Scolecithricella, **247.**
Scolecithrix, **243,** 249, 254.
Scottocalanus, **251.**
scutellata, Clytemnestra, **298.**
securifer, Pontella, **277.**
securifrons, Scottocalanus, **251.**
Setella, **298.**
setigera, Oithona, **282.**
setosus, Arietellus, **269.**
simillimus, Calanus, 212, **213.**
similis, Euchæta, 239.
,, Oithona, **283.**
,, Pareuchæta, **239,** 240.
simplex, Candacia, **273.**
speciosus, Corycæus, **291.**
spiniceps, Haloptilus, **268.**
,, Hemicalanus, 268.
spinifera, Phænna, **255.**
spinifrons, Heterorhabdus, **264.**
Spinocalanus, **227,** 232.
spinosus, Spinocalanus, **227.**
squillimana, Lubbockia, 286.
Stephus, **226.**
Streetsi, Chirundina, **234.**
stylifera, Temora, **257.**
styliremis, Calocalanus, **222.**
sub-brevicornis, Amallophora, 249.
,, Scaphocalanus, 249.
subcrassus, Eucalanus, **219.**
subtenuis, Eucalanus, **218.**
subtilis, Oncæa, **286.**

Temora, **257.**
Temoropia, **257.**
tenuicauda, Temora, 258.
tenuicornis, Calanus, **217.**
tenuimana, Idya, **298.**
tenuis, Corycæus, 295.
,, Oithona, **282.**
tenuispinus, Chiridius, 231.
,, Gaidius, **231.**
terranovæ, Scottocalanus, 211, **251.**
Thomasi, Scottocalanus, 252.
Thori, Scottocalanus, 251.
tonsus, Calanus, **216.**
turbinata, Temora, **258.**
typica, Amallophora, 252, 253.
typicus, Centropages, 257.
,, var. Aucklandicus, Centropages, 256.
,, Corycæus, **292.**

Undeuchæta, **233.**
Undina, 233.

valida, Scolecithrix, 243, **244.**
vanus, Ctenocalanus, **226.**
varicans, Candacia, **273.**
venusta, Euchirella, **237.**
,, Oncæa, 284.
,, var. venella, Oncæa, **284.**
venustus, Corycæus, 295.
violaceus, Centropages, **255.**
vipera, Heterorhabdus, 265, 266.
vitrea, Copilia, **290.**
vittata, Scolecithricella, **247.**
,, Scolecithrix, 247.
vorax, Sapphirina, **289.**

Wolfendeni, Euchæta, 238.

Xanthocalanus, **255.**
xiphias, Pleuromamma, **260.**

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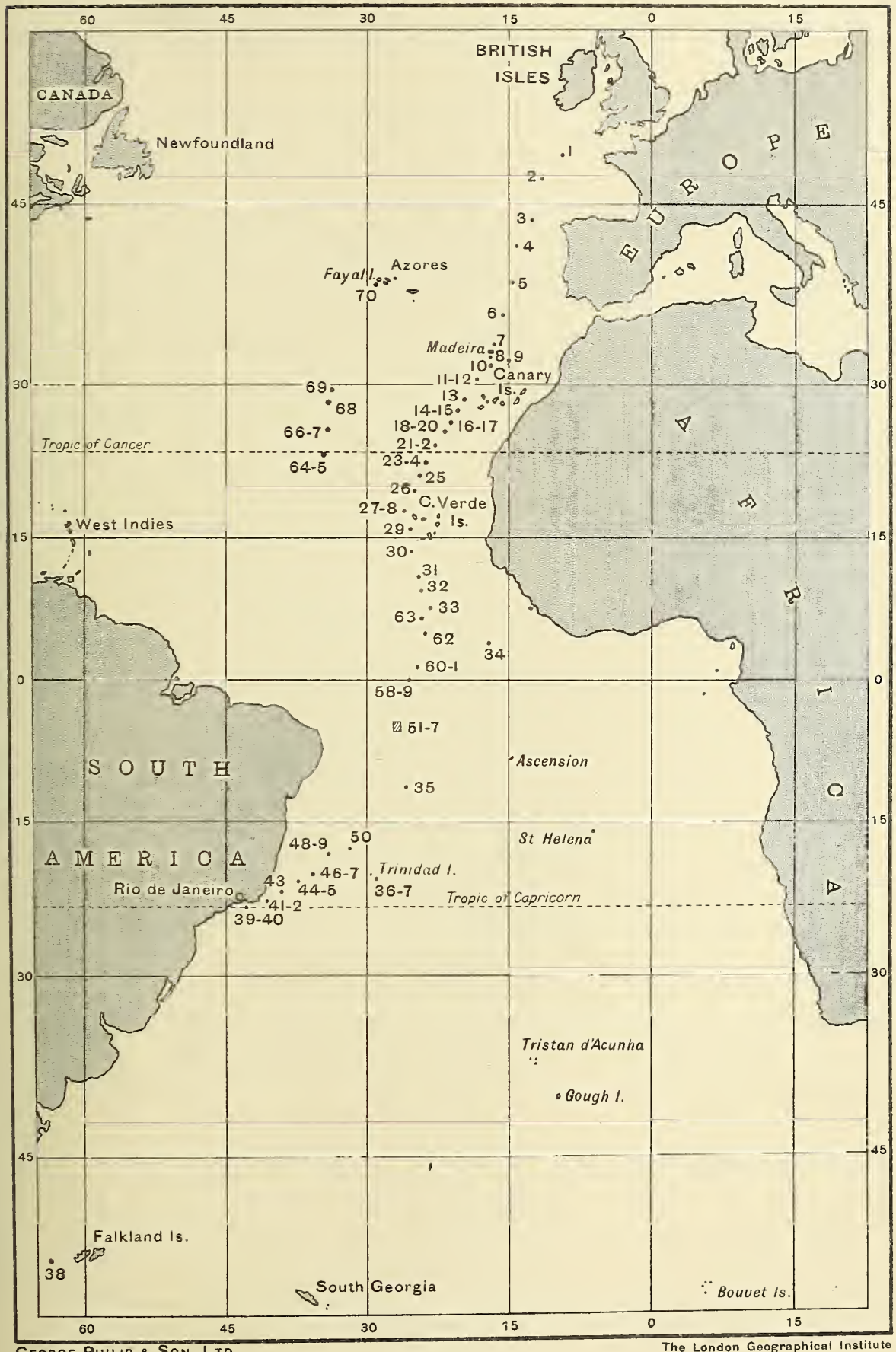

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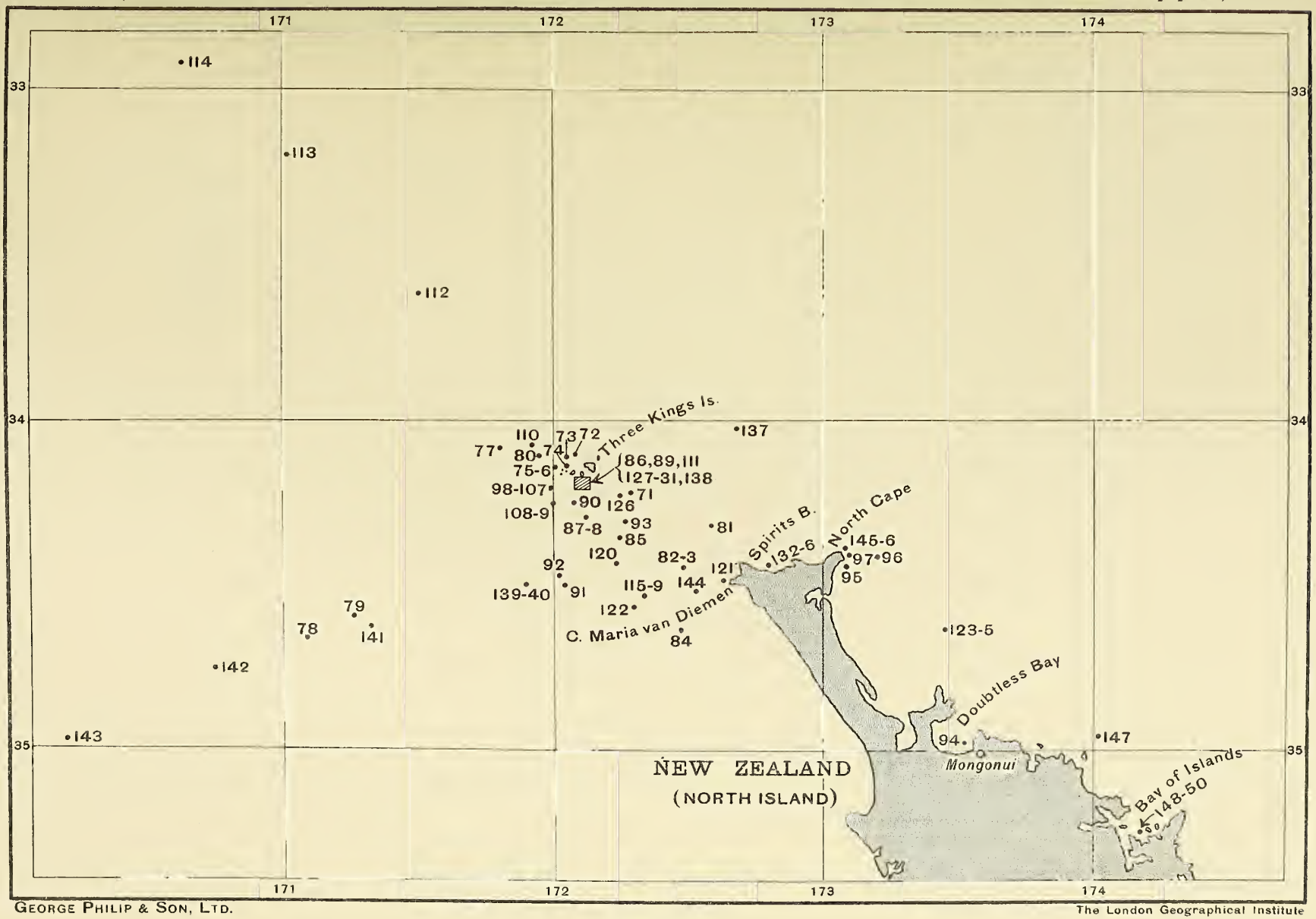

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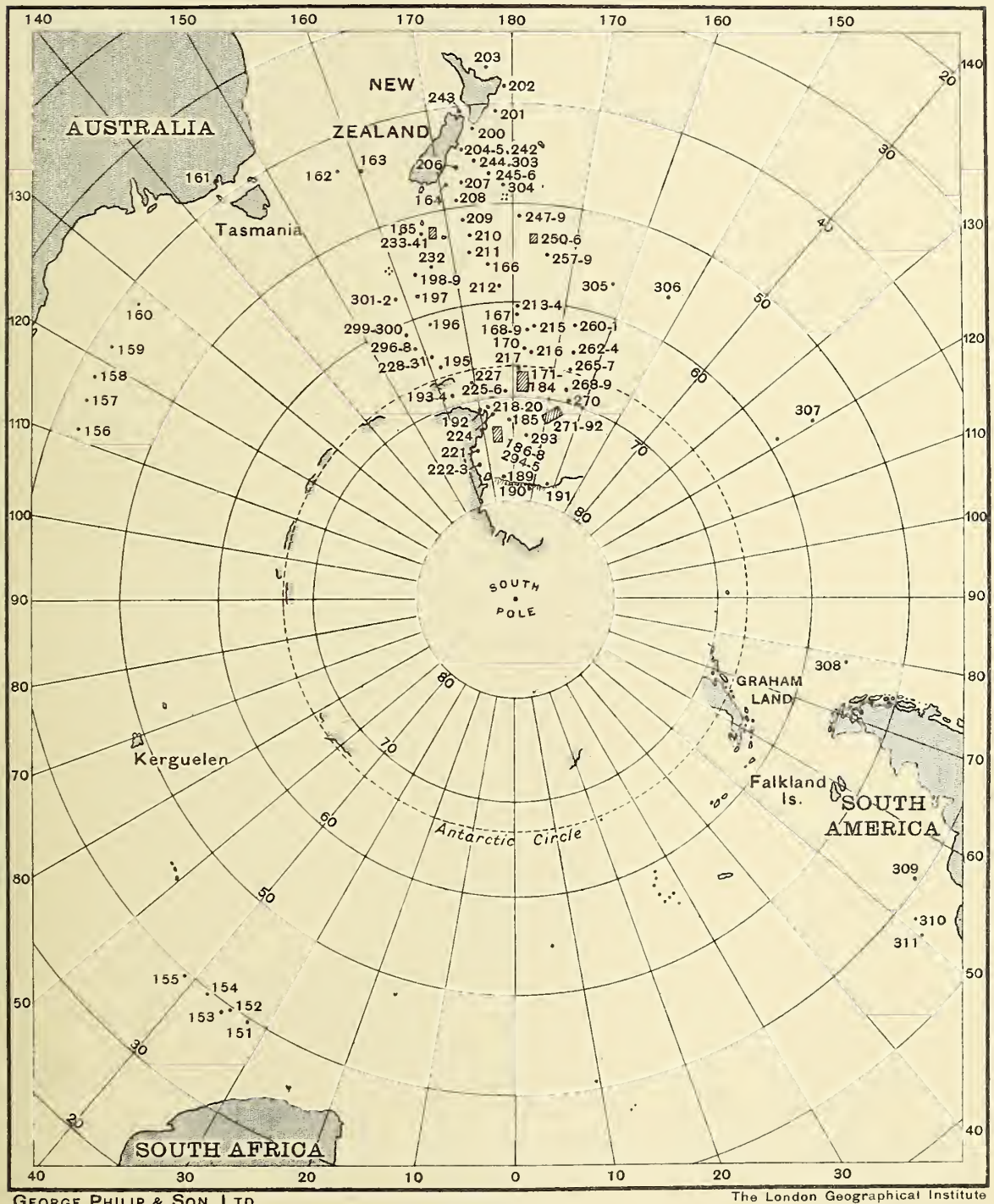

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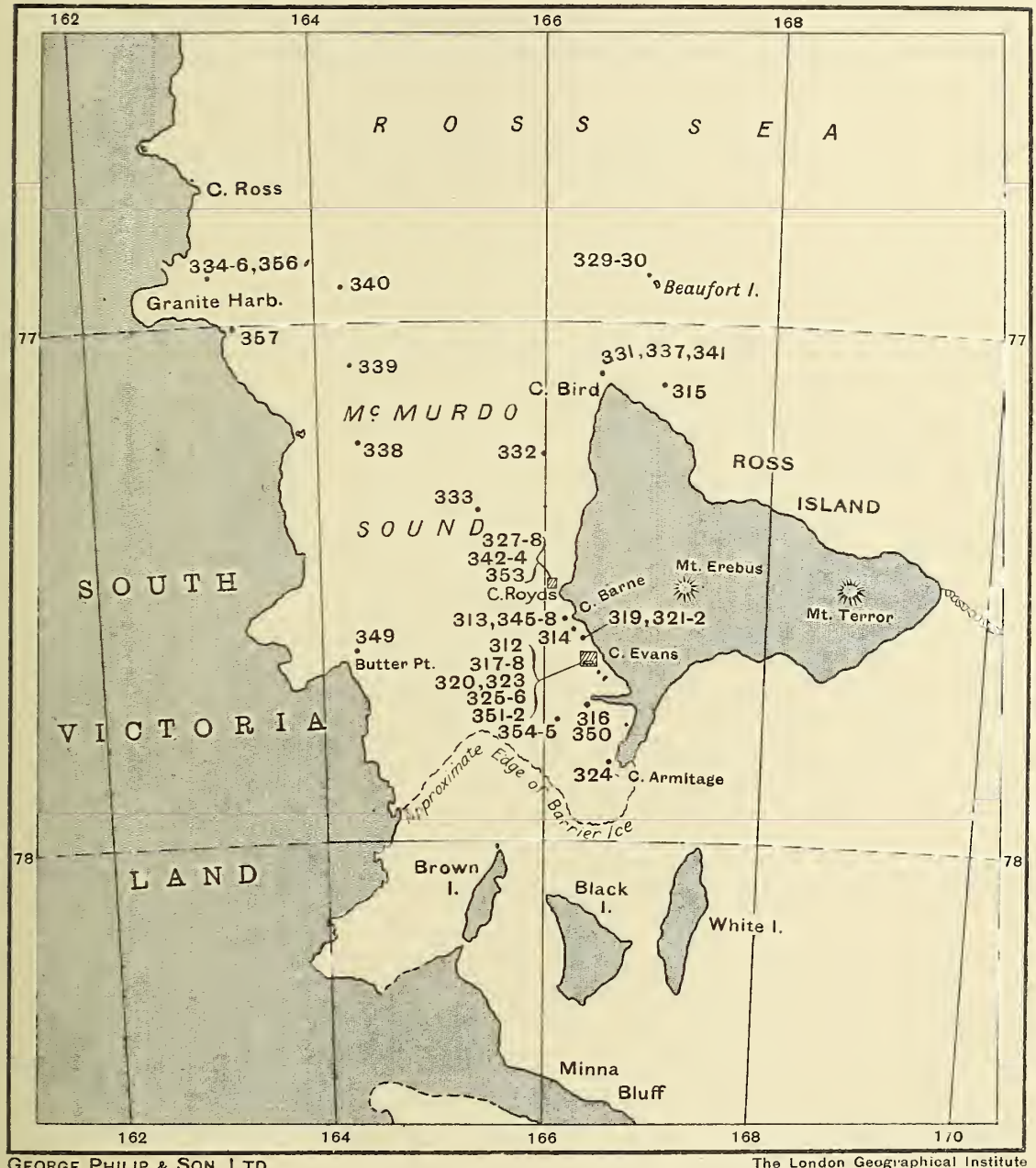

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BRITISH ANTARCTIC ("TERRA NOVA") EXPEDITION, 1910

NATURAL HISTORY REPORT.

ZOOLOGY. VOL. VIII, No. 4. Pp. 307–454.

CRUSTACEA.

PART XI.—AMPHIPODA.

BY

K. H. BARNARD, D.Sc., F.L.S.

WITH SIXTY-THREE TEXT-FIGURES.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM

SOLD BY

B. Quaritch, Ltd., 11 Grafton Street, New Bond Street, W.1; Dulau & Co., Ltd., 32 Old Bond Street, London, W.1; Oxford University Press, Warwick Square, London, E.C.4

AND AT

The British Museum (Natural History), Cromwell Road, S.W.7

1930

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Price Twelve Shillings and Sixpence.

[*Issued 26th July*, 1930]

British Museum (Natural History).

This is No. 3. *of* 25 *copies of "Terra Nova" Zoology, Vol. VIII., No.* 4, *Crustacea, Part XI., Amphipoda, printed on Special paper.*

AMPHIPODA.

BY K. H. BARNARD, D.Sc., F.L.S.

WITH 63 TEXT-FIGURES.

PAGE

1. Introduction 307

2. List of Stations at which Amphipoda were collected, with the Species obtained at each Station 309

3. General Observations 317

4. Systematic Notes and Descriptions of New Species 318

5. Bibliography 444

Appendix I. National Antarctic Expedition (1901–1904) 447

Appendix II. British Antarctic Expedition (1907–1909) 448

Index 451

I. INTRODUCTION.

The collection of Amphipoda obtained by the "Terra Nova" contains about 2450 specimens, viz. Gammaridea 769, Hyperiidea 1651, Caprellidea 30. The bulk of the collection was made in the regions around New Zealand and between New Zealand and the winter quarters in McMurdo Sound. The remainder was obtained at various stations in the Atlantic on the outward and homeward voyages.

The result of the activities of the "Terra Nova" naturalists has been a considerable increase in our knowledge of the Amphipodan fauna of the New Zealand and Ross Sea areas. In spite of the previous visits of the "Southern Cross" and the "Discovery" (1901–1904) to the latter area, or rather one should say in consequence of the experience gained on those expeditions, several undescribed species and species new to the area were collected.

The winter cruise of the "Terra Nova" to the area of the Three Kings Islands, off the north point of New Zealand, also proved fruitful in the collection of many species not hitherto included in the New Zealand fauna-list.

In this report 154 species are recorded; and 11 new genera and 37 new species are proposed.

Included in the collection as sent to me were a few specimens collected by the "Discovery" (1901–1904), and also the collection made by the "Nimrod," 1907–1909. The identifications of these specimens are contained in Appendices I and II. The species in the former collection have already been recorded by Walker (1907) and Stewart (1913), but every additional record may be of value in the future for working out the respective biological data.

Single Specimens.—Acting on the principle that the internal structure of a fossil skull cannot be investigated without dismembering the specimen, I have not hesitated to dissect single specimens of a species. The specimen frequently cannot be identified except by dissection; and so long as it remains unidentified, it remains a useless specimen.

If further justification be needed, one has only to note the errors which have crept into systematics by refraining from dissecting single specimens. For example, the peculiarities of "*Iphimedia*" *longipes* and *hodgsoni* were not originally suspected. In 1907 an undescribed species of *Epimeria* (here described as *robusta*) was wrongly identified by Walker with his own *inermis* described four years previously from an undissected specimen (1907, p. 24). With reference to a species of *Melphidippa*, Walker says (1907, p. 34) it was "in excellent condition and was therefore not dissected"; he identified it with a northern species, whereas it now appears probable that it is really referable to a distinct Antarctic species.

If such cautiousness in dissection leads to errors in classification, there is something to be said for the alleged "destruction" of single specimens. In the case of the present collection, after the specimens have been examined, the dissected parts have been replaced in a small tube in the phial containing the specimen, or if very minute, they have been mounted on microscope slides.

This collection was first entrusted to the late Dr. Chilton. Owing to several reasons Dr. Chilton found himself unable to proceed with the study of the collection, which was then transferred to me early in 1929. I have to acknowledge my indebtedness to Dr. Calman for the privilege of being asked to write this report, and to Dr. Chilton for his ever-ready willingness to place his knowledge and experience at my disposal. I would also like to thank Dr. Isabella Gordon of the British Museum for transcriptions and tracings from several works not available in South Africa.

II. LIST OF STATIONS AT WHICH AMPHIPODA WERE COLLECTED, WITH THE SPECIES OBTAINED AT EACH STATION.

A.* *Atlantic Ocean, north of lat. 35° S.*

Station 1.—48° 21′ N. 9° 58′ W. 17.vi.10. Surface, 6.30 p.m.

Parathemisto gracilipes (Norman).

Station 39.—Six miles off Rio de Janeiro Harbour. 27.iv.13. 2 metres, night.

Hyperia latissima, Bov.

Station 40.—Same locality.

Hyperia latissima, Bov.
Simorhynchotus antennarius (Claus).

Station 43.—22° 6′ S. 39° 40′ W. 3.v.13. Surface, night.

Hyperia latissima, Bov.
Lycaea vincenti, Stebb.

Station 45.—21° S. 37° 50′ W. 4.v.13. Surface, night.

Scina curvidactyla, Chevr.
Leptocotis tenuirostris (Claus).
Rhabdosoma whitei, Bate.

Station 46.—20° 30′ S. 36° 30′ W. 4.v.13. Surface, night.

Phronima sedentaria (Forsk.).
Rhabdosoma armatum, M. Edw.

Station 47.—20° 31′ S. 36° 31′ W. 4.v.13. Surface, night.

Corophium bonellii (M. Edw.).
Thyropus sphaeroma, Claus.
Amphithyrus glaber, Spandl.

Station 49.—18° 51′ S. 33° 40′ W. 6.v.13. Surface, night.

Lanceola felina, Bov.
Streetsia porcellus (Claus).

Station 50.—18° S. 31° 45′ W. 7.v.13. Surface, night.

Synopia ultramarina, Dana.
Vibilia stebbingi, Behn. & Wolt.
Hyperia fabrei (M. Edw.).
,, *promontorii*, Stebb.
Phronima pacifica, Streets.
Simorhynchotus antennarius (Claus).
Leptocotis tenuirostris (Claus).
Caprella equilibra, Say.

Station 53.—5° S. 27° 15′ W. 12.v.13. 2 metres, 6–7 p.m.

Eusiropsis riisei, Stebb.
Scina crassicornis (Fabr.).
Hyperia promontorii, Stebb.
Anchylomera blossevillei, M. Edw.
Oxycephalus clausi, Bov.
Amphithyrus bispinosus, Claus.
Tetrathyrus forcipatus, Claus.

Station 58.—0°. 25° 15′ W. 16.v.13. Surface, night.

Scina crassicornis (Fabr.).
Vibilia stebbingi, Behn. & Wolt.
,, *propinqua*, Stebb.
Hyperia fabrei (M. Edw.).

Station 59.—0°. 25° 15′ W. 16.v.13. Surface, night.

Scina crassicornis (Fabr.).
Vibilia stebbingi, Behn. & Wolt.
Hyperia fabrei (M. Edw.).
Phronima atlantica, var. *solitaria*, Guer.
Anchylomera blossevillei, M. Edw.
Brachyscelus crusculum, Bate.

Station 61.—2° N. 24° 45′ W. 17.v.13. Surface, night.

Vibilia viatrix, Bov.
,, *stebbingi*, Behn. & Wolt.
Hyperia fabrei (M. Edw.).
Phronima pacifica, Streets.
Phronimella elongata, Claus.
Anchylomera blossevillei, M. Edw.
Thyropus sphaeroma, Claus.
Tetrathyrus forcipatus, Claus.

Station 62.—4° 50′ N. 24° W. 18.v.13. Surface, night.

Vibilia propinqua, Stebb.

* In part IV. the localities of sections A–E are given as, Atlantic, North; Atlantic, South; Antarctic; New Zealand and Australia respectively.

A. *Atlantic Ocean, north of lat.* 35° *S.—continued.*

Station 63.—6° 10′ N. 24° 5′ W. 19.v.13. Surface, night.

Scina crassicornis (Fabr.).

Station 64. 23° 28′ N. 34° 45′ W. 26.v.13. Surface, night.

Scina crassicornis (Fabr.).
Hyperia promontorii, Stebb.
Lycaeopsis zamboangae (Stebb.).

Station 65.—23° 28′ N. 34° 45′ W. 26.v.13. Surface, night.

Paraphronima crassipes, Claus.

Station 66.—25° 35′ N. 34° 10′ W. 27.v.13. Surface, night.

Scina crassicornis (Fabr.).
Phronima atlantica, Guer.
Phronimella elongata, Claus.
Lycaeopsis themistoides, Claus.
Simorhynchotus antennarius (Claus).
Streetsia challengeri, Stebb.

Station 67.—25° 35′ N. 34° 10′ W. 27.v.13. Surface, night.

Vibilia stebbingi, Behn. & Wolt.
Paraphronima crassipes, Claus.
Phrosina semilunata, Risso.
Anchylomera blossevillei, M. Edw.
Simorhynchotus antennarius (Claus).

Station 68.—27° 22′ N. 33° 40′ W. 28.v.13. Surface, night.

Vibilia viatrix, Bov.
Paraphronima crassipes, Claus.
Phronimella elongata, Claus.
Calamorhynchus pellucidus, Streets.
Streetsia challengeri, Stebb.
Rhabdosoma brevicaudatum, Stebb.
Amphithyrus bispinosus, Claus.
Paratyphis parvus, Claus.
Tetrathyrus forcipatus, Claus.

Station 69.—29° 10′ N. 33° 36′ W. 29.v.13. Surface, night.

Streetsia challengeri, Stebb.

B. *Off the coast of South America and the Falkland Islands, south of lat.* 35° *S.*

Station 38.—West of Falkland Islands. 13.iv.13. 229 metres. Bottom fauna.

Chosroes incisus, Stebb.
Epimeria inermis, Wlkr.
Hyperia galba (Mont.).

Station 308.—West of Cape Horn (55° 29′ S. 78° 54′ W.). 9.iv.13. 4 metres, day.

Parathemisto gaudichaudii (Guer.).

Station 310.—Off Argentine coast (36° 57′ S. 51° 21′ W.). 21.iv.13. Surface, day.

Thyropus sphaeroma, Claus.

Station 311.—Off Argentine coast (35° 29′ S. 50° 26′ W.). 22.iv.13. 2 metres, day.

Lycaeopsis zamboangae (Stebb.).
Eupronoe armata, Claus.
Rhabdosoma whitei, Bate.

C. *Antarctic Regions, south of lat.* 60° *S.*

Station 167.—61° 22′ S. 179° 56′ W. 7.xii.10. Surface, day.

Parathemisto gaudichaudii (Guer.).

Station 178.—67° 23′ S. 177° 59′ W. 15.xii.10. 0–500 metres, 9 p.m.

Parascina setosa, n. sp.
Scina borealis (Sars).
„ *antarctica*, Wagler.

Station 181. 68° 41′ S. 179° 28′ W. 22.xii.10. From Penguin stomach.

Cyllopus lucasii, Bate.

Station 194.—Oates Land. 22.ii.11. 329–366 metres, bottom fauna.

Hirondellea antarctica (Schell.).
Steqocephaloides vanhöffeni, Schell.
Ampelisca hemicryptops, n. sp.
Leptamphopus novaezealandiae (Thoms.)
Gnathiphimedia mandibularis, n. g., n. sp.
Iphimediella cyclogena, n. sp.
Echiniphimedia hodgsoni (Wlkr.).
Epimeria macrodonta, Wlkr. forma *typica*.
Epimeriella scabrosa, n. sp.
Eusirus perdentatus, Chevr.
Aeginoides gaussi, Schell.

Station 217.—66° 46′ S. 177° 48′ W. 29.xii.11. 10 metres, day.

Parathemisto gaudichaudii (Guer.).

Station 219.—Off Cape Adare. 3.i.12. 10 metres, 5–6.30 p.m.

Paramoera walkeri (Stebb.).

C. *Antarctic Regions, south of lat.* 60° *S.—continued.*

Station 220.—Off Cape Adare. 3.i.12. 82–92 metres, bottom fauna.

Aristias antarcticus, Wlkr.
Tryphosa adarei, Wlkr.
,, *kergueleni* (Miers).
Heterophoxus videns, n. sp.
Seba antarctica, Wlkr.
Proboloides perlatus, n. sp.
Acanthonotozomella oatesi, n. sp.
Epimeria robusta, n. sp.
Eusirus antarcticus, Thoms.
Paramoera serraticauda (Stebb.).
Eurystheus distichon, n. sp.
Jassa falcata (Mont.).
Caprellinoides spinosa, n. sp.
Aeginoides gaussi, Schell.

Station 224.—Off Cape Adare. 9.iii.12. 1 metre, 7–9 p.m.

Hyperoche capucinus, n. sp.

Station 229.—64° 3′ S. 160° 12′ E. 18.iii.12. 80 metres, day.

Parathemisto gaudichaudii (Guer.).

Station 230.—64° 3′ S. 160° 12′ E. 18.iii.12. 80 metres, day.

Parathemisto gaudichaudii (Guer.).
Primno macropa, Guer.

Station 264. 64° 33′ S. 166° 30′ W. 26.xii.12. 20 metres, 9 p.m.

Parathemisto gaudichaudii (Guer.).

Station 267.—66° 30′ S. 166° 8′ W. 27.xii.12. Surface, 8–8.30 p.m.

Hyperiella dilatata, Stebb.

Station 269.—68° 37′ S. 166° 14′ W. 28.xii.12. Surface, 6–8 p.m.

Eusirus antarcticus, Thoms.
Vibilia antarctica, Stebb.
Hyperiella dilatata, Stebb.
Primno macropa, Guer.

Station 270.—69° 51′ S. 166° 17′ W. 29.xii.12. 0–600 metres, 8 p.m.

Scina borealis (Sars).

Station 276.—71° 41′ S. 166° 47′ W. 5.i.13. 0–1750 metres, night.

Lanceola clausi, Bov.
Scina borealis (Sars).

Station 281.—71° 41′ S. 166° 47′ W. 6.i.13. 80 metres, day.

Hyperiella dilatata, Stebb.

Station 282.—71° 41′ S. 166° 47′ W. 7.i.13. 0–1000 metres, night.

Paralanceola anomala, n. g., n. sp.
Hyperiella dilatata, Stebb.

Station 284.—71° 49′ S. 167° 32′ W. 8.i.13. 80 metres, 5.15–7.30 p.m.

Scina antarctica, Wagler.
Hyperiella dilatata, Stebb.

Station 285.—71° 49′ S. 167° 32′ W. 8.i.13. 0–600 metres, 8–10 p.m.

Scina borealis (Sars).
Cyllopus lucasii, Bate.
Hyperiella dilatata, Stebb.

Station 289.—72° S. 168° 17′ W. 12.i.13. 24 metres, night.

Hyperia macronyx, Wlkr.
Hyperiella dilatata, Stebb.

Station 290.—72° S. 168° 17′ W. 12.i.13. 60 metres, day.

Hyperiella dilatata, Stebb.

Station 294.—Ross Sea. 15.i.13. 289 metres, bottom fauna.

Tryphosa adarei, Wlkr.

Station 314.—McMurdo Sound. 23.i.11. 406–441 metres, bottom fauna.

Ampelisca hemicryptops, n. sp.
Prolaphystius isopodops, n. g., n. sp.
Iphimediella margueritei, Chevr.
,, *brevispinosa*, n. sp.
Gnathiphimedia pacifica (Stebb.).
Echiniphimedia hodgsoni (Wlkr.).
,, *nodosa* (Dana).
Epimeria robusta, n. sp.
,, *macrodonta*, Wlkr. f. *typica* and *similis*.

Station 316.—McMurdo Sound. 9.ii.11. 348–457 metres, bottom fauna.

Waldeckia obesa (Chevr.).
Epimeria macrodonta, Wlkr. f. *typica* and *similis*.
Echiniphimedia robusta, n. sp.
Iphimediella margueritei, Chevr.
,, *cyclogena*, n. sp.
Gnathiphimedia mandibularis, n. g., n. sp.
,, *pacifica* (Stebb.).
Echiniphimedia hodgsoni (Wlkr.)
,, *scotti*, n. sp.
,, *nodosa* (Dana).
Eusiras perdentatus, Chevr.
Caprellinoides spinosa, n. sp.

C. *Antarctic Regions, south of lat.* 60° *S.—continued.*

Station 318.—McMurdo Sound. June–September, 1911. 175 metres, bottom fauna.

Tryphosa adarei, Wlkr.
Orchomenella pinguides, Wlkr.
Orchomenopsis chilensis (Hell.).
Echiniphimedia nodosa (Dana).
Epimeria puncticulata, n. sp.
Eusirus antarcticus, Thoms.

Station 321. McMurdo Sound. August, 1911. 180–250 metres, bottom fauna.

Eusirus antarcticus, Thoms.
Paramoera walkeri (Stebb.).

Station 326.—McMurdo Sound. 1911–1912. 4–40 metres, bottom fauna.

Orchomenella pinguides, Wlkr.
Orchomenopsis chilensis (Hell.).
Epimeriella macronyx, Wlkr.
Melphidippa antarctica, Schell.
Eusirus antarcticus, Thoms.
Hyperiella dilatata, Stebb.

Station 331. McMurdo Sound. 14.i.12. 457 metres, bottom fauna.

Aristias antarcticus, Wlkr.
Heterophoxus videns, n. sp.
Leucothoe spinicarpa (Abildg.)
Proboloides typica (Wlkr.).
Gnathiphimedia pacifica (Stebb.).
Epimeria macrodonta, Wlkr. f. *typica*.
,, *robusta*, n. sp.
Eusirus antarcticus, Thoms.
Atyloides quadridens, n. sp.
Haplocheira barbimanus (Thoms.).

Station 338.—McMurdo Sound. 23.i.12. 379 metres, bottom fauna.

Tryphosa adarei, Wlkr.
Iphimediella margueritei, Chevr.
Gnathiphimedia pacifica (Stebb.).
Maxilliphimedia longipes (Wlkr.).
Oediceroides calmani, Wlkr.
Epimeria macrodonta, Wlkr. f. *typica* and *similis*.
,, *inermis*, Wlkr.
,, *robusta*, n. sp.
Epimeriella walkeri, n. sp.
Eusirus perdentatus, Chevr.

Station 339.—McMurdo Sound. 24.i.12. 256 metres, bottom fauna.

Waldeckia obesa (Chevr.).
Tryphosa adarei, Wlkr.
Ampelisca hemicryptops, n. sp.
Paraphoxus pyripes, n. sp.
Iphimediella margueritei, Chevr.
,, *brevispinosa*, n. sp.
,, *rigida*, n. sp.
Gnathiphimedia pacifica (Stebb.).
Echiniphimedia nodosa (Dana).
Oediceroides calmani, Wlkr.
Epimeria macrodonta, Wlkr. f. *typica*.
,, *inermis*, Wlkr.
Epimeriella walkeri, n. sp.

Station 340. McMurdo Sound. 25.i.12. 293 metres, bottom fauna.

Paraphoxus pyripes, n. sp.

Station 342. McMurdo Sound. 31.i.12. 0–350 metres, day, plankton.

Epimeriella macronyx, Wlkr. (juv.).
Hyperiella dilatata, Stebb.

Station 343. McMurdo Sound. 1.ii.12. 0–600 metres, day, plankton.

Hyperia macronyx, Wlkr.

Station 348. McMurdo Sound. 13.ii.12. 366 metres, bottom fauna.

Echiniphimedia hodgsoni (Wlkr.).
Epimeria macrodonta, Wlkr. f. *typica* and *similis*.
,, *robusta*, n. sp.
Epimeriella walkeri, n. sp.
Eusirus antarcticus, Thoms.

Station 349.—McMurdo Sound. 15.ii.12. 146 metres, bottom fauna.

Epimeria robusta, n. sp.

Station 350.—McMurdo Sound. 4.iii.12. 250 metres, day, plankton.

Hyperiella dilatata, Stebb.

Station 351.—McMurdo Sound. April–June, 1912. 205 metres, plankton.

Syrrhoites anaticauda, n. sp.
Paramoera walkeri (Stebb.).

Station 354.—77° 46′ S. 166° 8′ E. 20.i.13. 12 metres, day.

Hyperia macronyx, Wlkr.

Station 355.—McMurdo Sound. 20.i.13. 547 metres, bottom fauna.

Gnathiphimedia mandibularis, n. g., n. sp.
,, *pacifica* (Stebb.).
Anchiphimedia dorsalis, n. g., n. sp.
Echiniphimedia hodgsoni (Wlkr.).
,, *nodosa* (Dana).

C. *Antarctic Regions, south of lat. 60° S.—continued.*

Epimeria macrodonta, Wlkr. f. *typica*.
,, *robusta*, n. sp.
Eusirus perdentatus, Chevr.
,, *antarcticus*, Thoms.

STATION 356.—McMurdo Sound. 22.i.13. 92 metres, bottom fauna.

Kerguelenia antarctica, n. sp.
Cheirimedon fougneri, Wlkr.
Epimeria macrodonta, Wlkr. f. *typica*.
,, *robusta*, n. sp.
,, *puncticulata*, n. sp.

STATION: Winter Quarters, date unrecorded.

Podoprionides incerta, Wlkr.

D. *New Zealand, and the subantarctic area south to lat. 60° S.*

STATION 80.—Off Three Kings Islands. 22.vii.11. 0–100 metres, day.

Hyperioides longipes, Chevr.
Phronima sedentaria (Forsk.).

STATION 83.—Off Three Kings Islands. 23.vii.11. 2 metres, day.

Phronima atlantica, Guer.

STATION 84.—Off Cape Maria van Diemen. 23.vii.11. 2 metres, night.

Phronima atlantica, Guer.
Lycaeopsis themistoides, Claus.

STATION 85.—Off Cape Maria van Diemen. 24.vii.11. 2 metres, night.

Peltopes productus, n. g., n. sp.
Vibilia stebbingi, Behn. & Wolt.
Hyperioides longipes, Chevr.
Phrosina semilunata, Risso.
Anchylomera blossevillei, M. Edw.
Lycaea bajensis, Shoemkr.
Hemityphis rapax (M. Edw.).

STATION 86.—Off Three Kings Islands. 25.vii.11. 3 metres, night.

Paradexamine pacifica (Thoms.).
Hyperioides longipes, Chevr.
Iulopis loveni, Bov.
Phronima atlantica, Guer.
Phronimella elongata, Claus.
Phrosina semilunata, Risso.
Lycaeopsis themistoides, Claus.
Oxycephalus piscator, M. Edw.
Calamorhynchus pellucidus, Streets.
Paratyphis parvus, Claus.

STATION 87.—Off Three Kings Islands. 25.vii.11. 30 metres, day.

Strcetsia challengeri, Stebb.

STATION 89.—Off Three Kings Islands. 25.vii.11. Surface, night.

Paradexamine pacifica (Thoms.).
Iulopis loveni, Bov.
Eupronoe minuta, Claus.
,, *maculata*, Claus.
Parapronoe campbelli, Stebb.
Tryphana malmi, Boeck.
Lycaea bajensis, Shoemkr.
Simorhynchotus antennarius (Claus).
Platyscelus serratulus, Stebb.
Amphithyrus bispinosus, Claus.

STATION 90.—Off Three Kings Islands. 25.vii.11. 183 metres, bottom fauna.

Paracyclocaris bidens, n. g., n. sp.
Andaniotes corpulentus (Thoms.).
,, *simplex*, n. sp.

STATION 92.—Off Three Kings Islands. 27.vii.11. Surface, night.

Vibilia stebbingi, Behn. & Wolt.
Paraphronima crassipes, Claus.
Phronima atlantica, Guer.
Phronimella elongata, Claus.
Phrosina semilunata, Risso.
Eupronoe minuta, Claus.
Parapronoe campbelli, Stebb.
Simorhynchotus antennarius (Claus).
Leptocotis tenuirostris (Claus).
Platyscelus serratulus, Stebb.
Paratyphis parvus, Claus.

STATION 93.—Off Three Kings Islands. 28.vii.11. Surface, night.

Liljeborgia dubia (Hasw.).
Scina borealis (Sars.).
Vibilia propinqua, Stebb.
,, *pyripes*, Bov.
Paraphronima crassipes, Claus.
Hyperia fabrei (M. Edw.).
,, *luzoni*, Stebb.
Hyperioides longipes, Chevr.
Iulopis loveni, Bov.
Phronima atlantica, Guer.
Phrosina semilunata, Risso.
Primno macropa, Guer.
Anchylomera blossevillei, M. Edw.
Amphithyrus bispinosus, Claus.

D. *New Zealand, and the subantarctic area south to lat. 60° S.—continued.*

Station 100.—Off Three Kings Islands. 4.viii.11. Surface, day.

Brachyscelus crusculum, Bate.
Simorhynchotus antennarius (Claus).

Station 101.—Off Three Kings Islands. 4.viii.11. Surface, day.

Vibilia viatrix, Bov.
Brachyscelus crusculum, Bate.

Station 103.—Off Three Kings Islands. 4.viii.11. Surface, day.

Iulopis loveni, Bov.
Phronimella elongata, Claus.

Station 106.—Off Three Kings Islands. 4.viii.11. Surface, 7–8 p.m.

Protophoxus australis, n. g., n. sp.
Phronima sedentaria (Forsk.).
Anchylomera blossevillei, M. Edw.
Paralycaea gracilis, Claus.
Simorhynchotus antennarius (Claus).
Platyscelus serratulus, Stebb.

Station 107.—Off Three Kings Islands. 4.viii.11. Surface, night.

Paradexamine pacifica (Thoms.).
Vibilia viatrix, Bov.
Iulopis loveni, Bov.
Tryphana malmi, Boeck.
Platyscelus serratulus, Stebb.
Amphithyrus bispinosus, Claus.
Paratyphis spinosus, Spandl.
,, *parvus*, Claus.

Station 109.—Off Three Kings Islands. 5.viii.11. 3 metres, night.

Liljeborgia dubia (Hasw.).
Paradexamine pacifica (Thoms.).
Vibilia viatrix, Bov.
,, *chuni*, Behn. & Wolt.
Iulopis loveni, Bov.
Parathemisto australis (Stebb.).
Phronimella elongata, Claus.
Anchylomera blossevillei, M. Edw.
Lycaea pauli, Stebb.
Brachyscelus crusculum, Bate.
,, *rapacoides*, Steph.
Platyscelus serratulus, Stebb.
Tetrathyrus pulchellus, n. sp.

Station 110.—Off Three Kings Islands. 6.viii.11. Surface, night.

Phoxocephalus bassi, Stebb.
,, *regium*, n. sp.
Vibilia robusta, Bov.
Iulopis loveni, Bov.
Parathemisto australis (Stebb.).
Eupronoe minuta, Claus.
,, *maculata*, Claus.
Simorhynchotus antennarius (Claus).

Station 111.—Off Three Kings Islands. 7.viii.11. Surface, day.

Paradexamine pacifica (Thoms.).
Paraphronima crassipes, Claus.

Station 112.—33° 37′ S. 171° 30′ E. (N.W. of Three Kings Islands). 8.viii.11. 3 metres, day.

Phronima atlantica, Guer.
Phrosina semilunata, Risso.

Station 113.—33° 12′ S. 171° 05′ E. 9.viii.11. 3 metres, day.

Eupronoe minuta, Claus.
Streetsia challengeri, Stebb.

Station 118.—South of Three Kings Islands. 17.viii.11. Surface, night.

Vibilia robusta, Bov.
,, *armata*, Bov.
Iulopis loveni, Bov.
Lycaea pauli, Stebb.
,, *nasuta*, Claus.
Leptocotis tenuirostris (Claus).
Streetsia challengeri, Stebb.

Station 120.—South of Three Kings Islands. 18.viii.11. Surface, night.

Paradexamine pacifica (Thoms.).
Phronimella elongata, Claus.
Phrosina semilunata, Risso.
Primno macropa, Guer.
Leptocotis tenuirostris (Claus).
Platyscelus serratulus, Stebb.

Station 126.—Off Three Kings Islands. 24.viii.11. Surface, day.

Vibilia armata, Bov.
Hyperia fabrei (M. Edw.).
,, *luzoni*, Stebb.
,, *promontorii*, Stebb.
Parathemisto australis (Stebb.).
Phronima atlantica, Guer.
Anchylomera blossevillei, M. Edw.
Brachyscelus crusculum, Bate.

D. *New Zealand, and the subantarctic area south to lat.* 60° *S.—continued.*

Station 127.—Off Three Kings Islands. 25.viii.11. Surface, night.

Vibilia viatrix, Bov.
,, *propinqua*, Stebb.
Hyperia fabrei (M. Edw.).
Hyperioides longipes, Chevr.
Phronima atlantica, Guer.
Phronimella elongata, Claus.
Simorhynchotus antennarius (Claus).
Leptocotis tenuirostris (Claus).
Paratyphis parvus, Claus.

Station 129.—Off Three Kings Islands. 26.vii.11. Surface, night.

Vibilia robusta, Bov.
,, *viatrix*, Bov.
,, *propinqua*, Stebb.
Calamorhynchus pellucidus, Streets.

Station 130.—Off Three Kings Islands. 27.viii.11. Surface, night.

Synopioides macronyx, Stebb.
Regalia fascicularis, n. g., n. sp.
Vibilia viatrix, Bov.
,, *pyripes*, Bov.
Iulopis loveni, Bov.
Phronima atlantica, Guer.
Primno macropa, Guer.
Anchylomera blossevillei, M. Edw.
Brachyscelus crusculum, Bate.
Simorhynchotus antennarius (Claus).
Calamorhynchus pellucidus, Streets.
Leptocotis tenuirostris (Claus).
Streetsia porcellus (Claus).
,, *challengeri*, Stebb.
Platyscelus serratulus, Stebb.

Station 131.—Off Three Kings Islands. 27.viii.11. Surface, day.

Vibilia viatrix, Bov.
Phrosina semilunata, Risso.
Lycaea pauli, Stebb.
Simorhynchotus antennarius (Claus).

Station 133. North Cape. 30.viii.11. 20 metres, night.

Peltopes productus, n. g., n. sp.
Liljeborgia dubia (Hasw.).
Leptamphopus novaczealandiae (Thoms.).
Nototropis reductus, n. sp.
Paraphronima crassipes, Claus.
Anchylomera blossevillei, M. Edw.
Eupronoe minuta, Claus.

Station 134.—North Cape. 31.viii.11. 20–37 metres, bottom fauna.

Liljeborgia aequabilis, Stebb.
Caprellina longicollis (Nic.).

Station 135.—North Cape. 1.ix.11. 3 metres, night.

Tetradeion crassum (Chilt.).
Protophoxus australis, n. g., n. sp.
Trichophoxus capillatus, n. g., n. sp.
Liljeborgia dubia (Hasw.).
Bathymedon neozelanicus, n. sp.
Apherusa levis (Thoms.).
Polycheria antarctica (Stebb.).
Ischyrocerus anguipes, Kröy., var. *longimanus*, Hasw.

Station 136.—North Cape. 2.ix.11. Surface, night.

Protophoxus australis, n. g., n. sp.
Stenothoe ornata, n. sp.
Liljeborgia dubia (Hasw.).
Oediceroides microcarpus, n. sp.

Station 139.—34° 30′ S. 171° 53′ E. 6.ix.11. Surface, night.

Eusirus sp.
Scina crassicornis (Fabr.).
,, *borealis* (Sars.).
Vibilia propinqua, Stebb.
,, *chuni*, Behn. & Wolt.
Hyperia luzoni, Stebb.
Hyperoche sp.
Iulopis loveni, Bov.
Parathemisto australis (Stebb.).
Phronima atlantica, Guer.
Eupronoe maculata, Claus.
Lycaea pauli, Stebb.
Brachyscelus crusculum, Bate.
Hemityphis rapax (M. Edw.).

Station 141.—34° 47′ S. 171° 19′ E. 7.ix.11. Surface, night.

Vibilia viatrix, Bov.

Station 142.—34° 45′ S. 170° 45′ E. 8.ix.11. 2 metres, night.

Parathemisto australis (Stebb.).
Brachyscelus crusculum, Bate.

Station 143.—34° 58′ S. 170° 12′ E. 9.ix.11. Surface, night.

Phronima atlantica, Guer.
Leptocotis tenuirostris (Claus).
Platyscelus serratulus, Stebb.

D. *New Zealand, and the subantarctic area south to lat. 60° S.—continued.*

Station 206.—45° 25′ S. 172° 28′ E. 16.xii.11. Surface, day.

Cyllopus magellanicus, Dana.

Station 209.—51° 48′ S. 172° 18′ E. 19.xii.11. Surface, night.

Tetrathyrus forcipatus, Claus.

Station 210.—Off Campbell Island. 53° 35′ S. 173° 06′ E. 20.xii.11. Surface, day.

Paraphoxus pyripes, n. sp.

Station 235.—52° 41′ S. 168° 15′ E. 26.xii.12. 10 metres, 7–10 p.m.

Cyllopus magellanicus, Dana.
Parathemisto gaudichaudii (Guer.).
Phronima sedentaria (Forsk.).
Primno macropa, Guer.

Station 236.—52° 11′ S. 167° 25′ E. 27.iii.12. 80 metres, 6–8 p.m.

Phronima atlantica, Guer.

Station 237.—52° 11′ S. 167° 25′ E. 27.iii.12. 10 metres, night.

Parathemisto gaudichaudii (Guer.).
Primno macropa, Guer.

Station 238.—52° 11′ S. 167° 25′ E. 27.iii.12. 30 metres, day.

Vibilia armata, Bov.
Parathemisto gaudichaudii (Guer.).
Phronima sedentaria (Forsk.).
Primno macropa, Guer.

Station 240.—51° 57′ S. 167° 38′ E. 28.iii.12. 4 metres, day.

Cyllopus magellanicus, Dana.
Paraphronima crassipes, Claus.
Hyperioides longipes, Chevr.
Parathemisto gaudichaudii (Guer.).

Station 242.—Off Akaroa Heads. 2.iv.12. 10 metres, day.

Hippomedon incisus, n. sp.

Station 248.—51° 22′ S. 179° 18′ W. 18.xii.12. Surface, 7 p.m.

Hyperiella antarctica, Bov.

Station 250.—54° 2′ S. 177° 0′ W. 20.xii.12. Surface, day.

Cyllopus magellanicus, Dana.
Hyperiella antarctica, Bov.
Parathemisto gaudichaudii (Guer.).
Primno macropa, Guer.

Station 251.—54° 2′ S. 177° 0′ W. 20.xii.12. Surface, 8–8.30 p.m.

Cyllopus magellanicus, Dana.
Parathemisto gaudichaudii (Guer.).

Station 252.—54° 33′ S. 176° 55′ W. 21.xii.12. Surface, day.

Cyllopus magellanicus, Dana.
Parathemisto gaudichaudii (Guer.).

Station 256.—54° 38′ S. 176° 24′ W. 21.xii.12. 20 metres, 10 p.m.

Vibilia antarctica, Stebb.
Cyllopus magellanicus, Dana.
Parathemisto gaudichaudi (Guer.).

Station 259.—55° 34′ S. 174° 35′ W. 22.xii.12. 20 metres, 9 p.m.

Cyllopus magellanicus, Dana.

Station 302.—58° 21′ S. 158° 5′ E. 3.ii.13. 20 metres, 8.30 p.m.

Parathemisto gaudichaudii (Guer.).

Station 304.—48° 33′ S. 178° 28′ E. 16.iii.13. 4 metres, day.

Parathemisto gaudichaudii (Guer.).

Station 306.—55° 55′ S. 152° 39′ W. 24.iii.13. Surface, day.

Parathemisto gaudichaudii (Guer.).
Primno macropa, Guer.

Station 307.—55° 16′ S. 120° 3′ W. 1.iv.13. 6 metres, 6.15–8.45 p.m.

Primno macropa, Guer.

Station.—Off Campbell Island. 26.iii.12. 5 fathoms, night.

Phronima sedentaria (Forsk).

Station.—Off Campbell Island. 28.iii.12. Plankton, night.

Cyllopus magellanicus, Dana.
Parathemisto gaudichaudii (Guer.).
Phronima sedentaria (Forsk.).

E. *Australia.*

Station 161.—Melbourne Harbour. October, 1910. 12 metres.

Hyperia galba (Mont.).
Parathemisto australis (Stebb.).

III. GENERAL OBSERVATIONS.

Schellenberg (1926) has discussed the composition of the Amphipodan fauna of the Antarctic and Subantarctic regions. Even taking the present collection into account, it seems too soon thereafter to attempt any further analysis of the fauna.

One of the main results of the " Terra Nova " collecting is the demonstration that the Antarctic fauna-list is still capable of being materially increased. More extensive investigations along and in the neighbourhood of the Antarctic coast are certain to produce further additions which may quite likely upset some of our present conclusions.

A feature of the fauna of high latitudes as opposed to that of more tropical regions is the poverty of species compared with the abundance of individuals. It may be that this feature will be found to have been exaggerated when the Antarctic fauna is better known. True, the Lysianassid *Orchomenopsis chilensis* appears in such swarms as apparently to obliterate every other form from areas worked by the collecting gear (Walker, 1907, p. 14). But alongside this species (and one or two others) there is an abundant and varied fauna which is gradually being brought to light by successive expeditions.

Taking the Ross Sea—McMurdo Sound area (south of lat. 70° S.), we find that the " Southern Cross " brought back 22 species; the " Discovery " added 31; and the " Terra Nova " has added another 28 species, making a total of 81 species known from this area. If we take the whole Antarctic coast-line, Chevreux (1913, pp. 81 *sqq.*) lists about 90 species, and the " Gauss " added 37 species, in both cases allowing for synonyms; together with 20 n. spp. collected by the " Terra Nova " we have a total of approximately 150 species.

Among the most important additions made by the " Terra Nova " may be mentioned: 4 n. spp. of *Paramphithoidae* and 7 n. spp. of *Acanthonotozomatidae*, and an interesting new genus and species of the northern family *Lafystiidae*. Representatives of the *Caprellidae* from the actual Antarctic coast-line were only recently made known in the report on the " Gauss " collections.

A point of biological interest, which has been commented on by other authors (*e.g.* Chilton, 1909, p. 627), is the increase in size of individuals of a species as one passes from low to high latitudes. This phenomenon is exemplified in the present collection by the following species: *Leptamphopus novaezealandiae*, *Hyperioides longipes*, and *Phronima atlantica*. Spandl (1927, p. 275) counsels caution in assuming that " giant " forms are chiefly found in cold regions.

To carcinologists interested in the relationship of form and function, the variations in the mouth-parts of the *Acanthonotozomatidae* may be commended, although it may be long before we have any precise data as to the habits of these animals.

Lastly, bipolarity is a topic which may be mentioned only to dismiss it again. Schellenberg (1926) and Spandl (1927) have discussed it and stated their conclusion that true bipolar *species* do not exist. As the status of certain species is still uncertain,

owing to differences of opinion between various authors, the question of bipolarity is obviously not a very fruitful subject of inquiry.

Extensions of the known distribution of many species, especially pelagic ones, are being furnished by every successive oceanographical expedition. Such has been the case with the " Terra Nova " collecting in the New Zealand area, where the number of plankton hauls greatly exceeded that of bottom hauls. The number of new species from this area is small, affording a rather marked contrast with the Isopods from the same area (*cf.* Tattersall, " Terra Nova " Rep. iii. p. 192).

IV. SYSTEMATIC NOTES AND DESCRIPTIONS OF NEW SPECIES.

1. GAMMARIDEA.

Family LYSIANASSIDAE.

Stebbing, 1906, p. 8.

Gen. KERGUELENIA, Stebb.

Stebbing, 1906, p. 11 ; Schellenberg, 1926, p. 239.

This genus comprises *compacta*, Stebb., from Kerguelen, *glacialis*, Schell., from the " Gauss " winter quarters, and *borealis*, Sars, from the Arctic Ocean.

Kerguelenia antarctica, n. sp. (Fig. 1, *b*.)

Occurrence.—Sta. 356, Antarctic ; 1 ♂ 7 mm., 1 ovigerous ♀ 9 mm.

Description.—Lateral lobes of *head* extending forwards to about half length of lower margin of 1st joint of antenna 1. *Eyes* invisible. *Side-plate* 1 with convex

Fig. 1.—*a*, *Waldeckia obesa* (Chevr.), 4th and 5th side-plates slightly separated ; *b*, *Kerguelenia antarctica*, n. sp., inner view of antenna 1.

anterior margin. *Pleon* segment 4 with a well-marked concave depression on the hinder half.

Epistome not prominent. Apex of inner lobe of *maxilliped* rounded (as in *glacialis*). *Antenna* 1, general shape as in *glacialis*, but 2nd and 3rd joints of peduncle not angularly prominent, the 3rd joint of peculiar shape, subtriangular, the accessory flagellum inserted at upper apex, the flagellum sunk into the basal portion, accessory flagellum 2-jointed, flagellum apically broken in both specimens. Antenna 2, flagellum 7-jointed.

Peraeopod 3, 2nd joint as in *compacta*. *Peraeopods* 3–5, 2nd joint with hind margin entire. *Uropod* 3 uniramous.

Remarks.—These specimens resemble *compacta* in the unexpanded 2nd joint of peraeopod 3 and other features, but differ in the more prominent lateral lobes of the head, and the projecting keel of 1st joint of antenna 1. The inner lobes of the maxilliped are rounded. In the last three characters the specimens resemble *glacialis*, but *glacialis* has the 2nd joint of peraeopod 3 lobed distally, and the hind margins of 2nd joints of peraeopods 4 and 5 serrulate, in both of which characters it resembles *borealis* and differs from *compacta*.

As these specimens thus differ from the other three species in at least two characters, it seems necessary to institute a new specific name for them, especially as the shape of the 3rd joint of antenna 1 is distinctive and not found elsewhere. These specimens are considerably larger than any hitherto recorded, but it does not seem as if the differences can be due to differences in age.

Gen. HIRONDELLEA, Chevr.

Chevreux, 1900, p. 20, and 1910 (Bull. Inst. ocean. Monaco, 156), p. 1 ; Stebbing, 1906, p. 16 ; Stephensen, 1923, p. 63 (*Tetronychia*) ; Schellenberg, 1926, p. 251 (*Tetronychia*).

This genus comprised three species, all from the North Atlantic (*trioculata*, Chevr., from the Azores, *brevicaudata*, Chevr., from 43° N., 19° 42′ W., and *abyssalis* from South of Iceland) until Schellenberg described *antarctica* from the Antarctic.

There can be no question that *Tetronychia* should be united with *Hirondellea*. Chevreux did not describe any spinules on the dactylus of gnathopod 1 in either of his species, and the peculiar palmar projection is found only in *abyssalis* and *antarctica ;* but the details of the mouth-parts are in such exact agreement that the two genera cannot be maintained. The slenderness of the palps of maxilla 1 and maxilliped in Chevreux's figures (1900, pl. 4, figs. 1, *f* and *h*) is due, I believe, to their not being true profiles, but foreshortened. Stephensen figures the palp of maxilla 1 as narrower than it is in the " Terra Nova " specimen.

Hirondellea antarctica (Schell.). (Fig. 2.)

Schellenberg, 1926, p. 251, fig. 8 (*Tetronychia*).

Occurrence.—Sta. 194, Antarctic ; 1 ♀ 20 mm. (somewhat damaged).

Description.—Integument thin, smooth. *Head* with broadly rounded antero-lateral angles. Eyes invisible, without any trace of lenses or pigment. *Side-plates* 1–4 not as deep as their segments, 1 oblong, somewhat tapering below, apically rounded, 2 and 3 oblong, 4 excavate behind, lower hind margin even (not angular) ; 5 not quite as deep as long, divided into equal lobes by an emargination on lower margin. Postero-inferior angle of *pleon* segment 1 rounded, of segment 2 quadrate, but actual angle rounded,

of 3 rounded. *Telson* cleft to middle, apices of lobes rounded, each with a short stout spine.

Antenna 1, flagellum 20-jointed, 1st joint long, accessory flagellum 8-jointed. Antenna 2 longer than antenna 1, flagellum about 25-jointed. *Epistome* broadly rounded, separated from upper lip by a narrow groove. Mouth-parts as in Stephensen's figures of *abyssalis*. *Gnathopod* 1 strong, 2nd joint setose on anterior margin, 5th broadly triangular, 6th much narrower than distal width of 5th, oblong, palm nearly transverse but strongly concave, inferior apex produced as a short point bearing a long spine, giving a chelate appearance, dactylus with 3 spinules on inner margin as described for *abyssalis*. Gnathopod 2, 6th joint shorter than 5th, inferior apex acute though not prominent. *Peraeopods* 3–5 lost. Accessory branchiae, in the shape of

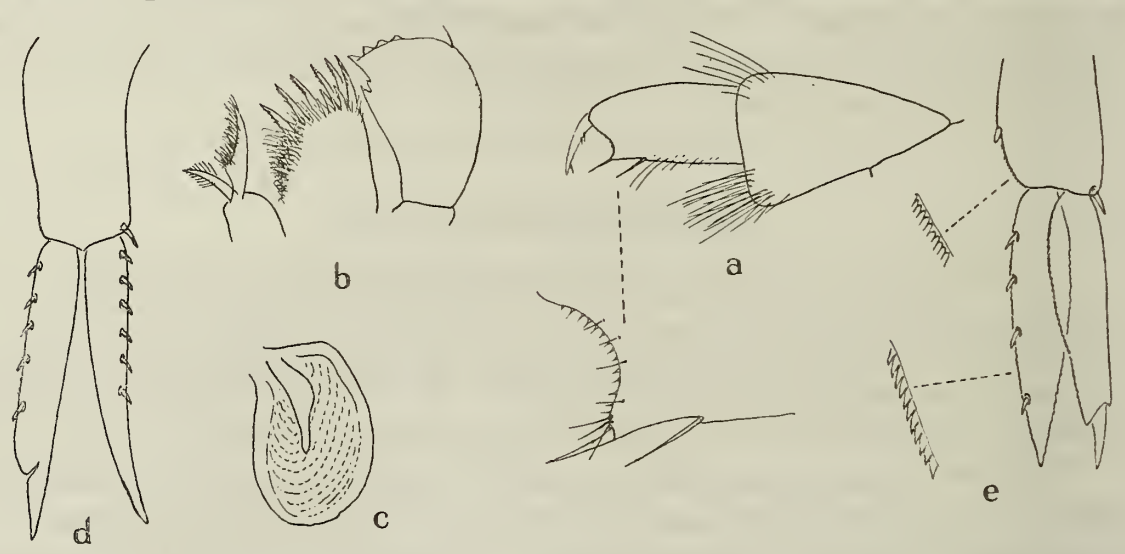

Fig. 2.—*Hirondellea antarctica* (Schell). *a*, gnathopod 1; *b*, maxilla 1; *c*, branchia with accessory branchia on segment 5; *d* and *e*, uropods 2 and 3.

short, apically pointed processes, present on segments 5 and 6. *Uropod* 2, inner ramus abruptly narrowed towards apex as in *trioculata*, outer margin of outer ramus and inner margin of inner ramus with short stout spines. Uropod 3, inner distal margin of peduncle minutely pectinate, and all margins of rami except outer margin of outer ramus minutely serrulate.

Remarks.—The 2nd uropods resemble those of *trioculata*, the telson resembles that of *brevicaudata* and *abyssalis*, and the 1st gnathopod resembles that of *abyssalis*. Neither Chevreux, Stephensen, nor Schellenberg mentions the presence of accessory branchiae.

The question whether *antarctica* is different from *abyssalis* is difficult to answer. Schellenberg did not draw attention to any differences. The present specimen is much larger than any of Stephensen's or Schellenberg's specimens. The greater length of the antennae might indicate a male, but that the brood lamellae are present though not fully developed. As far as I can see, there are only slight differences in the shape

of side-plate 1 and the relative widths of the 5th and 6th joints of gnathopod 1 between the " Terra Nova " specimen and *abyssalis*. Schellenberg's specimen is much more like Stephensen's in this latter feature.

Distribution.—" Gauss " winter station, 385 metres.

Gen. PODOPRIONIDES, Wlkr.

Walker, 1907, p. 16 ; Schellenberg, 1926, p. 242.

Podoprionides incerta, Wlkr.

Walker, 1907, p. 17, pl. 5, fig. 8 ; Schellenberg, 1926, p. 242, fig. 3.

Occurrence.—Winter quarters, date unrecorded. 1 ♂ 4 mm.

Remarks.—The telson corresponds with Schellenberg's figure except that the inner apical tooth on each lobe is longer than the outer tooth.

Distribution.—McMurdo Sound ; " Gauss " winter station, 385 metres.

PARACYCLOCARIS, n. g.

Head deep. Side-plates 1 and 2 very small ; 3 and 4 deep, posterior process of 4 fitting into a groove on 5. Telson ovate, entire. Eyes invisible. Epistome prominent. Mandible with narrow entire cutting-edge, minute secondary plate on one side, molar small, not denticulate, palp inserted behind molar. Maxilla 1 with palp slender, 1-jointed. Maxilla with both plates narrow. Maxilliped with inner plates relatively large. Gnathopods 1 and 2 slender, 1st simple. Peraeopods 1–5 stout, 4th joint expanded and decurrent. Uropod 3 uniramous. Branchiae simple.

Remarks.—This genus belongs to that section of the *Lysianassidae* characterised by the relatively very small 1st and 2nd side-plates, viz. *Cyphocaris*, *Cyclocaris* and allied genera ; it is apparently nearer to *Cyclocaris*, but possesses very distinctive features of its own.

Paracyclocaris bidens, n. sp. (Figs. 3, 4.)

Occurrence.—Sta. 90, New Zealand ; 2 ♀♀ 7 mm., 2 ♀♀ (1 ovigerous, 1 with embryos) 6 mm., 1 ♀ 5·5 mm., 2 juv. 3·5 mm.

Description.—*Integument* indurated, surface sparsely pitted. *Body* robust, the head and first two peraeon segments curving downwards (in the figure they are drawn extended). *Head* with a short rostral process between the deep sockets of the 1st antennae. No trace of eyes. *Peraeon* segments rounded dorsally, postero-lateral angles of all the segments subacute. *Side-plates* 1 and 2 much smaller than, and concealed by, side-plate 3, both subtriangular, the 2nd narrowed below like a bottle neck ; side-plate 3 as deep as its segment, front margin strongly convex ; 4 large, produced behind into a subacute tooth which fits into a groove on the 5th side-plate. *Pleon* segments 1 and 2 with indications of a medio-dorsal keel, which becomes definite

on the 3rd segment where it ends in a prominent triangular tooth. Postero-inferior angle of segment 1 rounded, of segments 2 and 3 quadrate. Posterior margin of segment 3 with a notch in middle of side, into which fits a low dorso-lateral keel on segment 4. Segment 4 basally depressed between the two dorso-lateral keels, and ending in a median upstanding triangular tooth. *Telson* ovate, entire, dorsally concave between the lateral margins.

Antenna 1 moderately stout, flagellum 8-jointed, accessory flagellum 4-jointed, the 1st joint in both much longer than any of the others. Antenna 2 subequal to antenna 1, flagellum 8-jointed, 1st joint largest. *Epistome* very prominent, angularly projecting, without visible demarcation between it and upper lip. *Mandible* slender, cutting edge narrow, entire, secondary cutting plate minute, spine-row apparently absent, molar small, not denticulate, palp well developed. *Lower lip*, lobes apically acute, mandibular

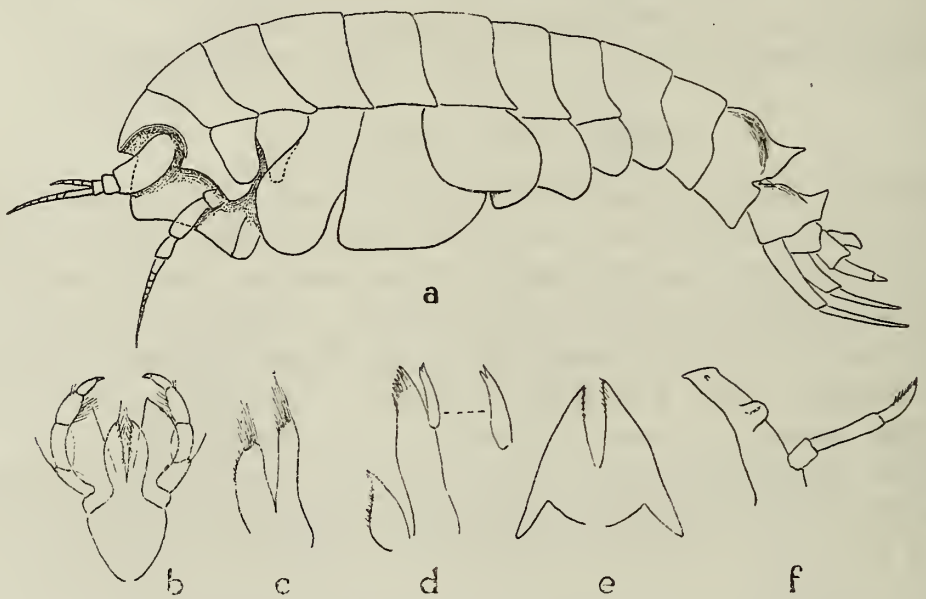

Fig. 3.—*Paracyclocaris bidens*, n. g., n. sp. *a*, general view; *b*, maxilliped; *c*, maxilla 2; *d*, maxilla 1; *e*, lower lip; *f*, mandible.

processes narrow. *Maxilla* 1, inner plate ovate, inner margin with fine setules; palp slender, 1-jointed, tapering apically where it ends in 2 minute spine-teeth. Maxilla 2 with both lobes narrow. *Maxilliped*, inner lobes large, inner margins with numerous setae, outer lobes not much larger, margins smooth, palp 4-jointed, not extending far beyond outer plates. *Gnathopod* 1 slender, simple, 6th joint longer than 5th, 7th with recurved setules on hind margin, and a short stout unguis. Gnathopod 2 slender, 6th joint shorter than 5th, 7th hook-like, meeting the minutely bidentate lower angle of the concave palm. *Peraeopods* 1 and 2 stout, 4th joint anteriorly expanded and decurrent, a few small spines on anterior margin of 2nd joint and some stout ones on hind margins of 5th and 6th joints. Peraeopod 3 stout, 2nd joint narrow, its lower hind apex produced in a rounded lobe, 4th joint posteriorly expanded and

decurrent, spines on anterior margin of 5th and 6th joints as on the hind margin in peraeopods 1 and 2. Peraeopod 4, 2nd joint nearly circular, 4th joint more strongly decurrent than in peraeopod 3. Peraeopod 5, 2nd joint broadly oblong, hind margin scarcely crenulate, 4th joint still more strongly expanded and decurrent. *Uropod* 3,

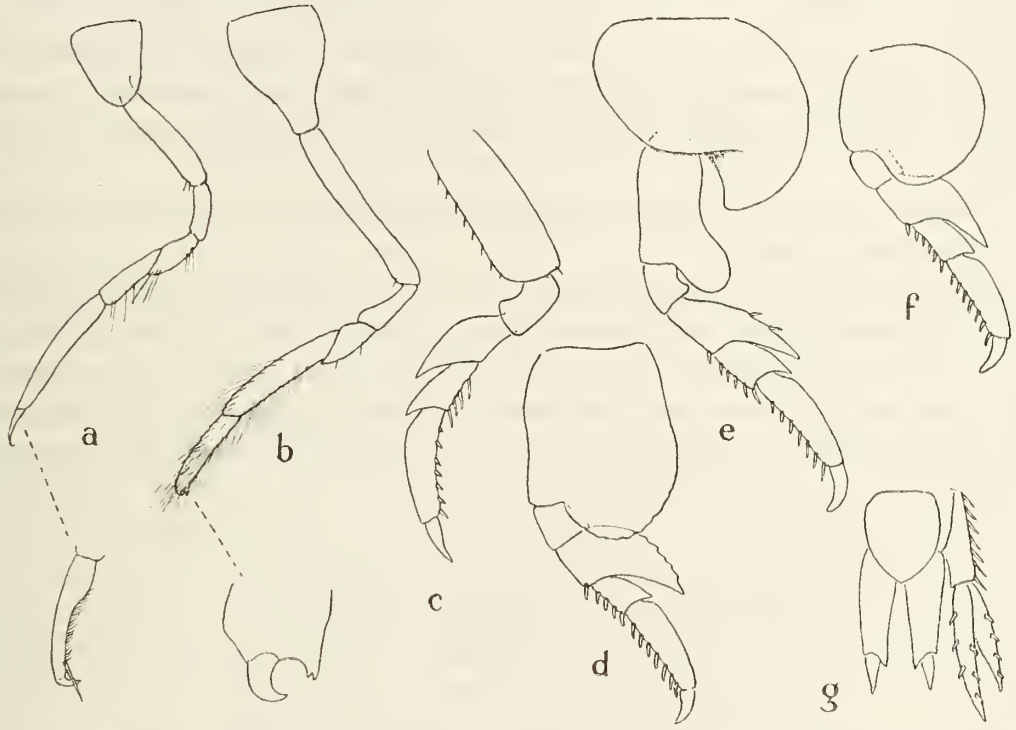

Fig. 1.—*Paracyclocaris bidens*, n. g., n. sp. *a*, gnathopod 1; *b*, gnathopod 2; *c*, peraeopod 1; *d*, peraeopod 5; *e*, peraeopod 3; *f*, peraeopod 4; *g*, telson and uropods 2 and 3.

peduncle extending beyond telson, inner apex acutely produced, ramus much shorter than peduncle.

Remarks.—The yoking of the 4th and 5th side-plates is comparable with that found in *Waldeckia obesa*.

Both the largest specimens, one of which was dissected, are undoubtedly ♀♀, and the 5·5 mm. specimen seems to be also a ♀, though it has not been opened out.

Gen. WALDECKIA, Chevr.

Chevreux, 1906, p. 13; Stebbing, 1910, p. 570; Chilton, 1912, pp. 472, 473.

Waldeckia obesa (Chevr.). (Fig. 1, *a*.)

Chevreux, 1906, p. 15, figs. 8–10, and 1913, p. 91; Walker, 1907, p. 10, pl. 2, fig. 4; Chilton, 1912, p. 471 (*zschauii*, non *Anonyx zschauii*, Pfr.); Chilton, 1913, p. 56 (*zschauii*, non *Anonyx zschauii*, Pfr.); Chevreux, 1913, p. 91; Schellenberg, 1926, p. 253, fig. 9.

Occurrence.—1. Sta. 316, Antarctic; 1 ♀ about 17 mm. (if extended). 2. Sta. 339, Antarctic; 1 ♀ 12 mm. (curled up).

Remarks.—I am entirely in agreement with Schellenberg that this species cannot be the *Anonyx zschauii* of Pfeffer. The conflict between the figures of the side-plates 1, 4 and 5, and of gnathopod 1 as given by Pfeffer for *A. zschauii* and by Chevreux and Walker for *W. obesa* cannot be ignored. One can only overcome this conflict by attributing to Pfeffer and his draftsman a capacity for inaccuracy which they certainly do not seem to merit. Nor can differences in age or size be adduced, as Schellenberg has examined both adults and young; and, moreover, Chevreux's example of *obesa* (17 mm.) was about the same size as Pfeffer's example of *zschauii* (15 mm.).

It seems to me that *A. zschauii* should be placed in the genus *Orchomenopsis*, as done by Stebbing in 1906.

Chevreux (1906, p. 14) has remarked upon the shape of the 5th side-plate in commenting upon Walker's suggestion (1906, p. 454) of placing *obesa* in the genus *Socarnes*. He has not, however, described it properly, merely saying that the lower margin is without any emargination (échancrure), and making no mention of the presence of any groove (sillon). Schellenberg has been the first to draw attention to this characteristic feature, and a figure of it is given here. This yoking together of the 4th and 5th side-plates occurs elsewhere, *e.g.* in *Paracyclocaris* (*supra*) and in *Epimeria*, in both of which examples the integument is also indurated. Stebbing (1910, p. 571) has referred to the great extension of the 4th side-plate under the 5th, mentioning *Kerguelenia* as another example in the family *Lysianassidae*. In *Kerguelenia*, however, the 4th side-plate does not fit into a groove in the 5th as it does in *Waldeckia*.

Accessory branchiae are developed in the present specimens on segments 2–6, but only one on each segment.

Distribution.—Coats Land, 161 fathoms; Palmer Archipelago and Graham Land, 92–200 metres; McMurdo Sound; "Gauss" Winter station.

Gen. ARISTIAS, Boeck.

Stebbings, 1906, pp. 49, 718.

Aristias antarcticus, Wlkr.

Walker, 1907, p. 11, pl. 3, fig. 5; Schellenberg, 1926, p. 255, fig. 10.

Occurrence.—1. Sta. 220, Antarctic; 1 ♂ (?) 11 mm. 2. Sta. 331, Antarctic; 1 ♂ 16 mm.

Remarks.—The specimens agree with Walker's description. The telson resembles Walker's figure and not Schellenberg's, and there are no serrations on the hind margins of the pleura of pleon segments 2 and 3 as stated by Schellenberg.

Distribution.—McMurdo Sound; Kerguelen.

Gen. HIPPOMEDON, Boeck.

Stebbing, 1906, pp. 58, 719 ; Stephensen, 1915, p. 36, and 1923, p. 89 ; Schellenberg, 1925, p. 116.

Hippomedon incisus, n. sp. (Fig. 5.)

Occurrence.—Sta. 242, N. Zealand ; 2 ♂♂ 6·5 mm.

Description.—In general like *denticulatus* (Bate). *Integument* without particular sculpture. *Rostrum* minute. Antero-lateral angle of head sub-acute. *Eyes* oval, consisting of a moderate number of ocelli, pale (as preserved). *Side-plates* 1 and 2 with a minute notch and setule at lower hind angle. *Pleon* segment 3 with postero-inferior angle acutely produced, with a notch between the acute process and the rest of the hind margin. *Telson* rather stout, lobes slightly dehiscent, not tapering much, apices rounded-truncate, with 3 little spinules set in notches, the innermost the smallest, the outermost the largest, 2 submarginal spines, one in middle, one near base.

Antenna 1, upper apices of 1st and 2nd joints produced, but not prominently, flagellum about 30-jointed, 1st joint enlarged, with brush of setae, remaining joints

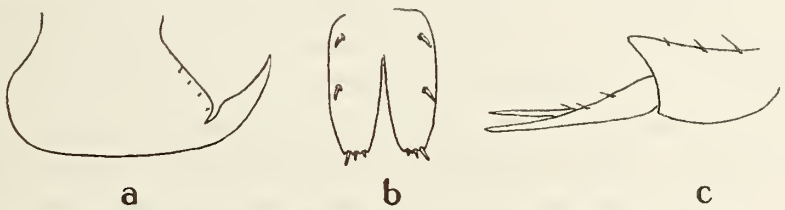

Fig. 5.—*Hippomedon incisus*, n. sp. *a*, pleon segment 3 ; *b*, telson ; *c*, lateral view of uropod 2.

calceoliferous, accessory flagellum 2-jointed. Antenna 2, flagellum about 55-jointed, calceoliferous. *Epistome* not prominent. Palp of maxilla 1 not apically widened, tipped with 5 denticles. Outer plate of maxilliped with 4–5 short, stout, blunt teeth or spines on inner distal margin. Mouthparts otherwise as in *denticulatus* (Sars., 1895, pl. 20). *Gnathopod* 1, 6th joint as long as, or a trifle longer than, 5th (measured along upper margins) palm oblique, defined by 2 spines and minutely pectinate. *Peraeopods* 3–5, 2nd joint ovate, hind margin feebly serrulate in peraeopods 3 and 4, more strongly so in peraeopod 5. Branchiae feebly pleated on one side. *Uropod* 1, rami subequal, peduncle and rami moderately spinulose. Uropod 2, peduncle dorsally keeled, rami subequal. Uropod 3, peduncle with circlet of spines on distal margin, rami subequal, spinulose, distally with long plumose setae, 2nd joint of outer ramus minute unguiform.

Remarks.—The resemblance to *denticulatus* (Bate) in the postero-inferior angle of pleon segment 3 is very striking, but noteworthy differences are found in the proportion of the 5th and 6th joints of gnathopod 1, the eyes, the 2nd uropod, and the telson.

The only other member of this genus hitherto found in Australasian waters is *geelongi*, Stebb.

Gen. CHEIRIMEDON, Stebb.

Stebbing, 1906, pp. 66, 720 ; Schellenberg, 1926, p. 262.

Cherimedon fougneri, Wlkr.

Walker, 1903, p. 41, pl. 7, figs. 1–6 ; Schellenberg, 1926, p. 263, fig. 13.

Occurrence.—Sta. 356, Antarctic ; 1 ♂ 16 mm., 1 ♀ 19 mm.
Distribution.—Ross Sea ; "Gauss" winter station, 385 metres.

Gen. TRYPHOSA, Boeck.

Stebbing, 1906, pp. 68, 720 ; Schellenberg, 1926, p. 266.

Tryphosa adarei, Wlkr.

Walker, 1903, p. 49, pl. 8, figs. 38–44 ; Schellenberg, 1926, p. 267, fig. 16 (*murrayi*, non Wlkr.) ; ? Walker, 1907, p. 16 (*murrayi* part) ; non Chilton, 1912, p. 467 (*murrayi*).

Occurrence.—Antarctic : 1. Sta. 220, 1 ♂ 22 mm., 8 ovigerous ♀♀ 20–24 mm. 2. Sta. 294, 2 ♀♀ 24 and 26 mm. (the larger ovigerous). 3. Sta. 318, 2 ♂♂ 27 and 29 mm., 1 ovigerous ♀ 29 mm. 3. Sta. 338, 2 ♂♂ 23 and 28 mm., 2 ♀♀ 28 and 31 mm. 5. Sta. 339, 1 ♂ 25 mm., 2 ovigerous ♀♀ 25 and 26 mm., 1 ♀ with embryos 27 mm.

Remarks.—Firstly, whether Walker in 1907 was right or wrong taxonomically in uniting his previously described two species *adarei* and *murrayi* under the latter name, he was wrong nomenclatorially in using this latter name instead of *adarei* which has page and figure precedence. Chilton and Schellenberg have followed suit. This, however, may be beside the point, if as it seems to me the two species are distinct.

Chilton (1912, p. 467) has identified the "Scotia" specimens with *murrayi* and has discussed the relationship of *murrayi*, *adarei* and *Tryphosella barbatipes* (Stebb.) *inter se.* Walker (1903) referred to the likeness of *adarei* to *barbatipes*, and Chilton considered that as regards the *first* gnathopod *adarei* was intermediate between *murrayi* and *barbatipes.* But nowhere in Chilton's discussion is any reference made to the *second* gnathopod, which is the distinguishing feature between *Tryphosa* and *Tryphosella* (Stebbing, 1906, pp. 67, 68).

I have not had Chilton's advantage in examining type material in the British Museum, and Walker does not specially refer to the relative lengths of the 5th and 6th joints of the 2nd gnathopod in his 1903 description ; so that I am relying on the accuracy of his figure (pl. 9, fig. 48). This shows the 6th joint less (slightly) than half the length of 5th joint. For this reason I argue that it is *murrayi*, not *adarei*, which should be placed in the genus *Tryphosella* and should be regarded in fact as synonymous with *barbatipes.* Between the relative lengths of the 5th and 6th joints in *Tryphosella* and *Tryphosa* there appear to be no transitional forms.

Thus, if my view be correct, the "Scotia" specimens should be regarded as

barbatipes ; but what the " Discovery " specimens were cannot be determined without further examination of them.

Schellenberg states that in gnathopod 2 the 6th joint is over one-half the length of the 5th, but does not discuss the question of this gnathopod, though he refers to age and locality differences in the relative lengths of the 5th and 6th joints of the 1st gnathopod.

Distribution.—Ross Sea ; " Gauss " winter station, 385 metres.

Tryphosa kergueleni (Miers).

Stebbing, 1888, p. 623, pl. 8, and 1906, p. 69 ; Walker, 1907, p. 16 ; Chilton, 1909, p. 617 ; Schellenberg, 1926, p. 266, fig. 15.

Occurrence.—Sta. 220, Antarctic ; 1 ♂ 19 mm.

Remarks.—Walker makes no mention of the length of his specimens or of any points in which they differ from Stebbing's description and figures.

The single specimen is nearly twice the size of the " Challenger " ♀, and the only noticeable difference is in the 1st *gnathopod,* which is stouter than in Stebbing's figure, with a less oblique palm. The 2nd gnathopod is also rather stouter (cf. Schellenberg) ; possibly Stebbing's figures of both these limbs, especially as regards the 5th and 6th joints, are not quite true profiles, and the width of the joints is thus foreshortened. Inner plate of *maxilla* 1 with 4 plumose setae apically, as Chilton (1912, p. 468) found to be the case in his specimen of *murrayi.* The 2nd *antenna* reaches to the end of peraeon segment 6.

Distribution.—Kerguelen ; McMurdo Sound ; " Gauss " winter station ; New Zealand.

Gen. ORCHOMENELLA, G. O. Sars.

Stebbing, 1906, pp. 81, 720.

Orchomenella pinguides, Wlkr.

Walker, 1903, p. 46, pl. 8, figs. 24–30, and 1907, p. 13 ; Schellenberg, 1926, p. 284, fig. 24.

Occurrence.—Antarctic : 1. Sta. 318. 1 ♂ 10 mm. 2. Sta. 326. Winter, 1911. 2 ♀♀ 8 and 9 mm.

Distribution.—McMurdo Sound ; " Gauss " winter station.

Gen. ORCHOMENOPSIS, G. O. Sars.

Stebbing, 1906, pp. 83, 721 ; Schellenberg, 1926, p. 287.

Orchomenopsis chilensis (Hell.), forma *rossi,* Wlkr.

Walker, 1907, p. 14 (*rossi*) ; Chilton, 1912, p. 473 ; Schellenberg, 1926, p. 287, figs. 26–29.

Occurrence.—Antarctic : 1. Sta. 318, 11.iv.11. 180 metres. 21 ♂♂ and ♀♀ up to 21 mm. 2. Sta. 318, 13.vi.11. 180 metres. A large number ♂♂ and ovigerous

♀♀ and juv. up to 20 mm. 3. Sta. 318, 11.viii.11. 175 metres. A lot ♂♂, ovigerous ♀♀ and juv. up to 18 mm. 4. Sta. 318, 29.viii.11. 180 metres. A lot ♂♂, ♀♀ and juv. up to 12 mm. 5. Sta. 318, 15.ix.11. 180 metres. A lot ♂♂, ♀♀ and (mostly) juv. up to 16 mm. 6. Sta. 326, 16.vi.11. 10 fathoms. 25 ♂♂, ♀♀ and juv. up to 19 mm. 7. Sta. 326, 11.viii.12, from penguin skeleton. A lot ♂♂, ovigerous ♀♀ and juv. up to 20 mm.

Distribution.—Ross Sea; South Georgia; "Gauss" winter station.

Family STEGOCEPHALIDAE.

Stebbing, 1906, p. 88; Stephensen, 1925, p. 127.

Gen. STEGOCEPHALOIDES, G. O. Sars.

Stebbing, 1906, p. 91; Barnard, 1916, p. 128; Schellenberg, 1926, p. 298.

Stegocephaloides vanhöffeni, Schell. (Fig. 6.)

Schellenberg, 1926, p. 299.

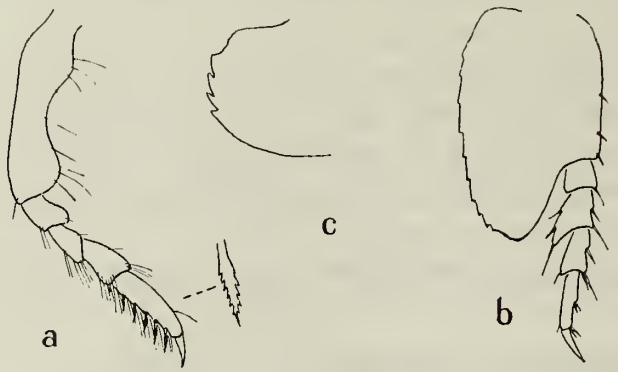

Fig. 6.—*Stegocephaloides vanhöffeni*, Schell. *a*, gnathopod 1; *b*, peraeopod 5; *c*, pleon segment 3.

Occurrence.—Sta. 194, Antarctic; 1 apparently ♂ 5·5 mm.

Remarks.—To judge by the description the present specimen seems to be correctly identified. Figures are here given, as Schellenberg gave none.

Distribution.—"Gauss" winter station, 385 metres.

Gen. ANDANIOTES, Stebb.

Stebbing, 1906, p. 96.

Andaniotes corpulentus (Thoms.).

Stebbing, 1906, p. 96, and 1910, p. 575.

Occurrence.—Sta. 90, New Zealand; 1 ovigerous ♀ 5 mm.

Distribution.—New Zealand; South-East Australia; 66° 40′ S., 40° 35′ W. Port Charcot, 15–2012 metres.

Andaniotes simplex, n. sp. (Fig. 7.)

Occurrence.—Sta. 90, New Zealand; 4 ♀♀, of which 1 ovigerous, 5 mm.

Description.—Resembling *corpulentus* except in the maxilliped and gnathopods 1 and 2. *Maxilliped* considerably smaller in comparison with the other mouth-parts,

outer plates with scarcely any setae, palp much reduced, 3-jointed, 1st joint (1st and 2nd combined) forming a fusiform joint, much wider than the two distal joints. Palp of *maxilla* 1 more slender than in Stebbing's figure of *corpulentus*. *Gnathopods* 1 and 2 much more slender than in *corpulentus*, 5th joint in gnathopod 1 not so broad distally, 6th joint in gnathopod 2 narrow, tapering evenly from base to apex. Hind margin of 2nd joint of *peraeopod* 5 scarcely crenulate, front margin of 6th joint minutely serrulate.

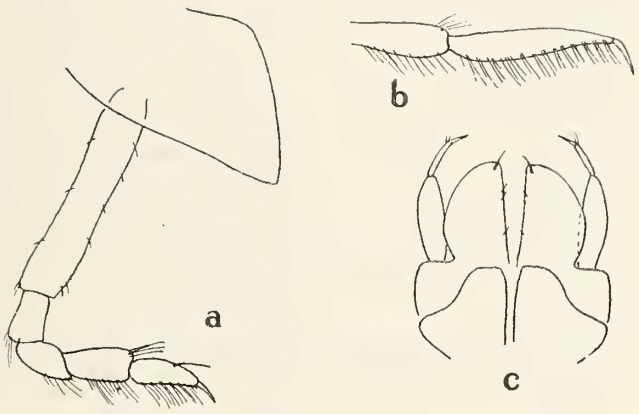

Fig. 7.—*Andaniotes simplex*, n. sp. *a*, gnathopod 1; *b*, distal joints of gnathopod 2; *c*, maxilliped.

Remarks.—It is possible that a new genus will be required for this form; at present I am content to leave it in the genus *Andaniotes*, especially as in the Antarctic form *ingens* there are signs of a reduction in size of the palp relatively to the outer plate in the maxilliped.

Gen. TETRADEION, Stebb.

Stebbing, 1906, p. 157; Chilton, 1924 a, p. 632.

Tetradeion crassum (Chilton).

Chilton, 1924 a, p. 631, figs. 1–20.

Occurrence.—Sta. 135, New Zealand; 15 specimens 2·5–3·5 mm.

Distribution.—New Zealand (Lyttelton Harbour, Oamaru, Hawke's Bay).

Family AMPELISCIDAE.

Stebbing, 1906, p. 97.

Gen. AMPELISCA, Kroyer.

Stebbing, 1906, pp. 98, 721; Barnard, 1916, p. 132, and 1925, p. 335; Schellenberg, 1925, p. 120.

Ampelisca hemicryptops, n. sp. (Fig. 8.)

Occurrence.—Antarctic: 1. Sta. 194, 3 ♀♀ 16, 18 and 22 mm. (the largest ovigerous). 2. Sta. 314, 2 ♀♀ 18 and 20 mm., the smaller ovigerous. 3. Sta. 339, 4 ♀♀ 20–23 mm (2 ovigerous).

Description.—These specimens exhibit in general the characteristics of *eschrichtii*. The 6th joint of *peraeopod* 5 is quite linear, abruptly narrower than 5th joint, and can by no means be termed "foliaceous" (*see* Stebbing's diagnosis, 1906). The *back* is

rounded, though the *anterior* 3 segments are very slightly narrowed dorsally, but scarcely keeled. The *head*, especially anteriorly, is distinctly keeled. The 4th *pleon* segment has a slightly projecting keel. *Uropod* 2 has no long apical spine on the outer ramus. *Telson* without dorsal spinules.

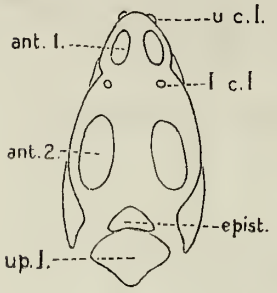

FIG. 8.—*Ampelisca hemicryptops*, n. sp. Semi-diagrammatic view of ventral surface of head. *u.e.l.* and *l.e.l.*=upper and lower corneal lenses; *ant.* 1, 2=antennae 1 and 2; *epist.*=epistome; *up.l.*=upper lip.

There is, however, one very puzzling peculiarity, a peculiarity which does not seem to have been noted elsewhere, certainly not by either Walker (1903 and 1907) or Chevreux (1906 and 1913) in their records of *macrocephala*, *eschrichtii* and *bouvieri*. There is only a single corneal lens on each side of the head (in the upper anterior angle), and no trace of any pigment which might represent the 2nd ocellus which is usually present. But on closer examination the 2nd corneal lens was found to be situated *within* the infero-lateral margin of the head, on the integument between the bases of the 1st and 2nd antennae. It is quite invisible when the animal is viewed sidewards.

Remarks.—The lower corneal lens is often situated on the actual lower margin of the head, but it seems to be unique for this lens to be actually within, and concealed by, the projecting lower margin. For this reason I feel that it is not advisable to refer these specimens to any of the three species * hitherto recorded from the Antarctic regions, viz. *macrocephala*, *eschrichtii* or *bouvieri*. The perfectly rounded back of the *posterior* peraeon segments is an additional reason.

FAMILY PHOXOCEPHALIDAE.

Stebbing, 1906, p. 133; Chevreux, 1908 (Bull. Mus. ocean. Monaco, No. 117) (new genus); Shoemaker, 1925, p. 22 (new genus).

GEN. PHOXOCEPHALUS, Stebb.

Stebbing, 1906, p. 134.

Phoxocephalus bassi, Stebb. (Fig. 9, *b*.)

Stebbing, 1888, p. 811, pl. 54, and 1910, p. 577; ? non Thomson, Ann Mag. Nat. Hist. (7), x. p. 463, 1902; ? non Chilton, 1909, p. 619.

Occurrence.—Sta. 110, New Zealand; 1 ♂ 7·5 mm.

Remarks.—This single specimen, though smaller than the "Challenger" specimen, agrees with Stebbing's description and figures. There is, however, one small feature

* Chilton (1917, J. Zool. Res. II. p. 75) regards all these three forms as one species identical with the northern species *eschrichtii*. But see also Stephensen, 1925, p. 140.

which doubtless Stebbing overlooked, viz. the little bunch of 3 setae within the margin on the postero-inferior angle of pleon segment 3. This may be a minor point, but in comparison with the following species it assumes importance.

The shape and ornamentation of the postero-inferior angle of the 3rd pleon segment should be closely studied in this family, as it would appear to afford good specific characters. For this reason, as well as on account of the 2nd gnathopod, I do not think that *kergueleni* should be regarded as a synonym of *bassi*.

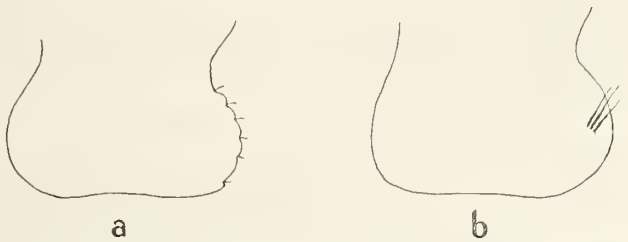

Fig. 9.—Pleon segment 3 of: *a*, *Phoxocephalus regium*, n. sp., and *b*, *Ph. bassi*, Stebb.

Distribution.—South-East Australia.

Phoxocephalus regium, n. sp. (Fig. 9, *a*.)

? Thomson, Ann. Mag. Nat. Hist. (7) x. 1902, p. 463 (*bassi*, non Stebb.); ? Chilton, 1909, p. 619 (*bassi*, non Stebb.).

Occurrence.—Sta. 110, New Zealand. 6.viii.11. Surface, night. 18 ♂♂ 4·5–5 mm.

Description.—Smaller than *bassi*, but otherwise very similar. *Rostrum* as in *bassi*. *Eyes* large, circular, approximate on top of head. *Side-plates* 1–4 with a few simple setae. *Pleon* segment 3 with postero-inferior angle rounded with about 6 little notches from each of which arises a short setule. *Telson* as in *bassi*. *Antennae* 1 and 2 as in *bassi*, but flagellum of antenna 1 relatively much shorter; the large spines on 4th joint of peduncle of antenna 2 as described and figured by Stebbing; the upper margin, however, is more densely furry than in *bassi*; flagellum of antenna 1 6-jointed, accessory flagellum 4-jointed, of antenna 2 28-jointed. *Gnathopod* 1, 5th joint oblong, longer than wide, palm nearly transverse, defined by a prominent triangular tooth bearing a spine. Gnathopod 2 similar but larger, like that of *kergueleni*. *Peraeopods* 1 and 2 like those of *bassi*, with the long strong spine on hind apex of 5th and 6th joints as in that species. Peraeopods 3 and 4 like those of *bassi*, but hind margins of 2nd joints with several notches from each of which arises a setule. Peraeopod 5 like that of *bassi*, hind margin of 2nd joint serrate. *Uropods* as in *bassi*, peduncle of uropod 1 with 2–3, of uropod 2 with 6–7, upstanding spines.

Remarks.—From the above description it will be seen how very close this species is to *bassi*. The two species are, however, easily separated by the characters of the 2nd gnathopod and the postero-inferior angle of the 3rd pleon segment, and the smaller size.

Chilton (1909, p. 619) in discussing the relationship between *bassi* and *kergueleni* says: "... if I am right in referring my New Zealand specimens to this species [i.e. *bassi*] its gnathopods are hardly so distinct from those of *kergueleni* as

shown in Stebbing's figure." I think it is clear, therefore, that Chilton had the present form before him, and probably Thomson's record of *bassi* refers to the same form.

The name alludes to the Three Kings Islands where the present specimens were taken.

Distribution (probably).—Otago Harbour, New Zealand.

Gen. PARAPHOXUS, G. O. Sars.

Stebbing, 1906, p. 137; Holmes, 1908 (Proc. U.S. Nat. Mus. xxxv.), p. 518; Chevreux and Fage, 1925, p. 103.

Paraphoxus pyripes, n. sp. (Fig. 10.)

Occurrence.—1. Sta. 210, New Zealand; 1 ♂ 7·5 mm. 2. Sta. 339, Antarctic; 1 ♀ 14 mm. Type. 3. Sta. 340, Antarctic; 1 ♀ 13 mm.

Description.—In general similar to *Phoxocephalus kergueleni*, but easily dis-

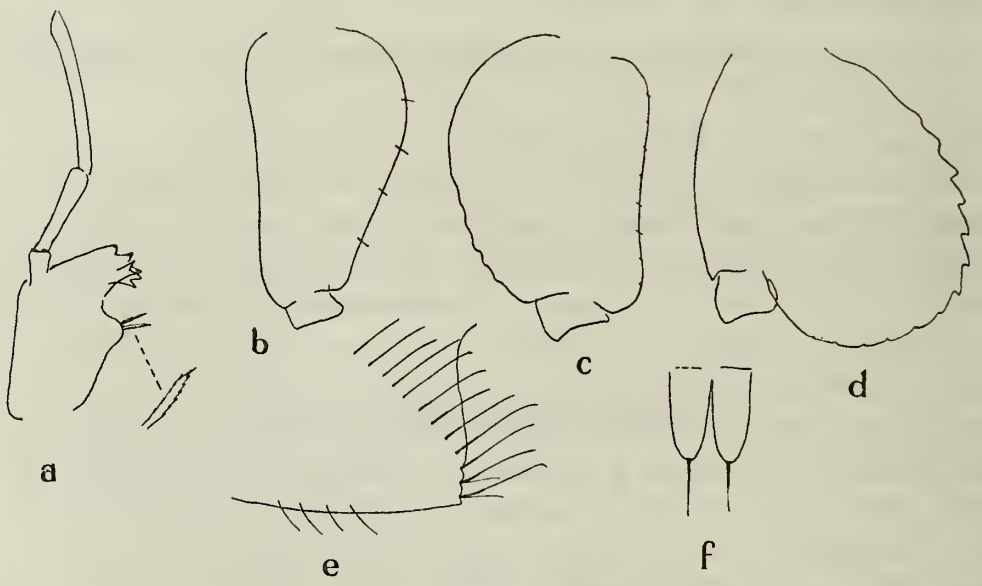

Fig. 10.—*Paraphoxus pyripes*, n. sp. *a*, mandible; *b*, *c*, *d*, 2nd joint of peraeopods 3, 4, and 5; *e*, pleon segment 3; *f*, telson.

tinguished by the 2nd joints of peraeopods 3 and 5, and the postero-inferior angle of pleon segment 3.

Eyes oval, small, dark in type (No. 2) but faded in paratype (No. 3). Postero-inferior angle of *pleon* segment 3 quadrate, with 3 small indents above the angle from which long setae arise, 6–7 more setae continue as an oblique row on the lateral surface, lower margin with a few long setae. *Telson* with the lobes rather elongate, each one tipped with 1 seta. *Mandible* with the projection representing the molar larger than in Sars' figure of *oculatus* (1895, pl. 51), tipped with 2 serrulate spine-setae, palp slender, 3rd joint elongate, longer than 1st and 2nd combined. *Gnathopods* 1 and 2, palm a

little more oblique than in *kergueleni*. *Peraeopod* 3, 2nd joint pyriform, expanded basally, tapering distally, hind margin nearly straight. Peraeopod 4, 2nd joint similar, somewhat tapering distally, the hind margin straight or slightly concave, lower hind angle rounded. Peraeopod 5, 2nd joint strongly expanded, hind margin with large serrations which become obsolete on lower margin. *Uropod* 2, a row of strong spine-setae on upper margin of peduncle.

The New Zealand specimen does not differ except in the usual sexual characters: large eyes, elongate flagellum of antenna 2, and lanceolate plumose rami of uropod 3. The setae on postero-inferior angle of pleon segment 3 are very well developed. The palms of gnathopods 1 and 2 are, however, more oblique.

Gen. HETEROPHOXUS, Shoemkr.

Shoemaker, 1925, p. 22 (June 18th).

With the 2nd joint of peraeopod 3 linear as in *Harpinia*, but with the following three characters as in *Paraphoxus:* eyes well developed, with corneal lenses, larger in ♂ than in ♀; 2nd antenna of ♂ elongate, calceoliferous; rami of uropod 3 in ♂ elongate, with plumose setae.

Remarks.—The only point in which the following species does not agree with the genus *Heterophoxus* is in the 1st maxilla. Shoemaker states that in *H. pennatus* the 1st maxilla has a 1-jointed palp; but his figure (3, *e*) shows a slight notch on the outer margin of the palp just where the division into two joints would be expected, and it is possible that the suture was overlooked. At any rate I think it is better to place the present species in *Heterophoxus* rather than create a new genus differing only in such a small point.

Harpiniopsis, Stephensen (June 19th, 1925), has the 2nd antennae in ♂ elongate, and possibly also the enlarged 3rd uropods (Stephensen had only a young ♂), but neither sex has eyes.

Chilton (1909, p. 610) has recorded specimens from New Zealand under the name *Harpinia obtusifrons* which differed from typical *Harpinia* in the above three characters belonging to *Paraphoxus*. It would seem more likely that these New Zealand specimens were wrongly placed and that *obtusifrons* should be struck out of the New Zealand fauna-list. Stephensen (1927, p. 306) records a ♀ specimen from the New Zealand area with eyes, but in the absence of a ♂ he could not do more than state that it should not be referred to *Harpinia*, and gave figures showing the differences between his specimen and Stebbing's *obtusifrons*.

Walker (1907) also recorded *obtusifrons* from McMurdo Sound but without any comments. As neither the "Nimrod" nor the "Terra Nova" obtained *obtusifrons* in the same area, but did obtain the species here described, it is probable that Walker's "Discovery" specimens should really be identified with the present species.

Chevreux's *Pontharpinia uncinata* is easily distinguished by the dilated 2nd joint of peraeopod 3, and cannot possibly be a synonym of either *obtusifrons* or the present species.

Heterophoxus videns, n. sp. (Fig. 11.)

? Walker, 1907, p. 17 (*Harpinia obtusifrons*, non Stebb.) ; ? Chilton, 1909, p. 619 (*H. obtusifrons*, non Stebb.) ; ? Stephensen, 1927, p. 306 (*H. obtusifrons*, non Stebb.).

Occurrence.—Antarctic : 1. Sta. 220, 2 ♂♂ 7–8 mm., 2 ♀♀ 7·5 and 5·5 mm., 1 juv. 3 mm. Types. 2. Sta. 331, 2 ♀♀ 5–6 mm.

Description.—Antero-lateral angle of *head* truncate, with a very small point below the eye. *Eyes* oval, or slightly narrower above, much larger in ♂ than ♀. *Side-plates* 1–3 with lower margins even, without notch at postero-inferior angle, with fairly numerous long plumose setae. *Pleon* segments dorsally setulose in ♀ and juv., but scarcely so in ♂. Postero-lateral margin of pleon segment 3 gently sinuous, postero-inferior angle produced in a short acute point, hind margin minutely setulose in ♀, smooth in ♂. *Telson* short, cleft nearly to base, lobes with apices rounded, each with 1 spine-seta on outer distal margin.

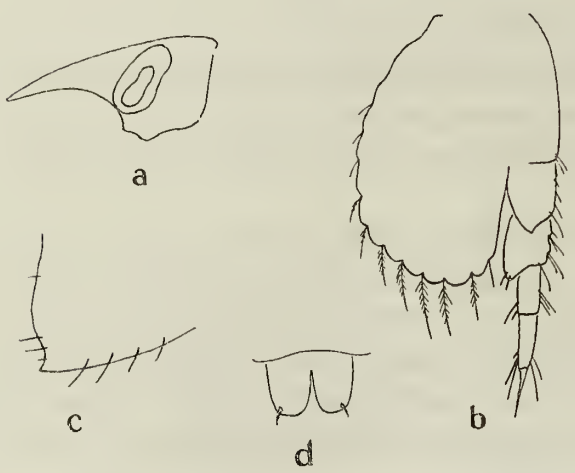

Fig. 11.—*Heterophoxus videns*, n. sp. *a*, head, the size of the eye of the male is represented by the outer line, that of the female by the inner line ; *b*, peraeopod 5 ; *c*, pleon segment 3 ; *d*, telson.

Antenna 1 of the *Harpinia* type (Sars, 1895, pl. 52), in ♀ 10-jointed, accessory flagellum 6-jointed, in ♂ more slender, flagellum 13-jointed, one or two calceoli on basal joints, accessory flagellum 7-jointed. Antenna 2 in ♀ like that of *Harpinia*, penultimate peduncular joint broad, triangular, ultimate joint much narrower, ovate, flagellum 10-jointed ; in ♂ of the *Paraphoxus* type (Sars, 1895, pl. 51), 3rd and 4th joint stout with thick brush of setae on upper margin, a group of stout spines at upper apex of 4th joint, 5th joint longer and narrower than 4th, upper margin with tufts of setae and 4–5 calceoli, flagellum extending to end of pleon segment 3, 36–40-jointed, nearly every joint calceoliferous. *Mouth-parts* similar to those of *Harpinia plumosa* (Sars, pl. 52). *Gnathopods* 1 and 2, peraeopods 1–4, cf. those of *H. plumosa*. *Peraeopod* 5, 2nd joint ovate, expanding distally and extending to end of 4th joint, hind margin with large rounded teeth, with plumose setae in the notches. *Uropods* as in *Paraphoxus oculatus* (Sars, pl. 51) ; uropod 3 in ♀ inner ramus not so short compared with the outer ramus ; in ♂ both rami subequal, with long plumose setae ; 2nd joint of outer ramus in ♀ minute, in ♂ absent.

Remarks.—This species is distinguished from the Californian *pennatus*, Shoemkr., by the 3rd pleon segment and the rounded teeth on hind margin of 2nd joint of peraeopod 5.

Distribution (probably).—New Zealand, Auckland and Campbell Islands; and McMurdo Sound; having been wrongly recorded as the Kerguelen species *Harpinia obtusifrons*.

PROTOPHOXUS, n. g.

Like *Phoxocephalus*, but maxilla 1 with well-developed 2-jointed palp, and 5th joint of both gnathopods elongate.

Remarks.—The gnathopods are unlike those of any member of the family except the following genus and *Joubinella*, Chevr., but in the latter genus the 5th joint in gnathopod 2 is excessively slender, giving the limb a strong resemblance to that of *Eusirus*.

Protophoxus australis, n. sp. (Fig. 12.)

Occurrence.—New Zealand: 1. Sta. 106, 2 ♂♂ 8–9 mm. 2. Sta. 135, 5 ♂♂ 5–8 mm., 1 ♀ 6 mm., 2 juv. 3·5–4 mm. Types. 3. Sta. 136, 3 ♂♂ 6·5–7 mm.

Description.—In general facies like *Phoxocephalus bassi* (Stebb.). *Eyes* much larger

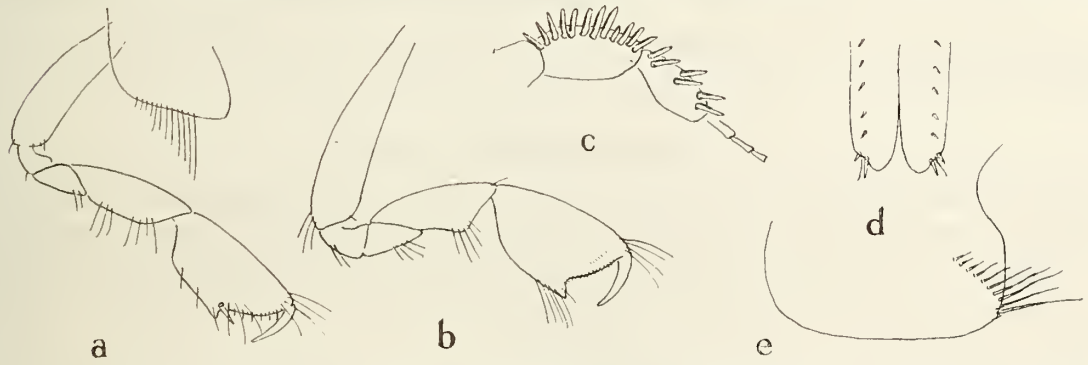

Fig. 12.—*Protophoxus australis*, n. g., n. sp. *a*, gnathopod 1; *b*, gnathopod 2; *c*, peduncle of antenna 2; *d*, telson; *e*, pleon segment 3.

in ♂ than in ♀, nearly contiguous on top of head. *Side-plates* 1–4 deep, 4 a little deeper than long, lower margins with moderately numerous long simple setae. *Pleon* segment 3 with postero-inferior angle rounded, with a small notch from which starts an oblique row of setae of gradually diminishing length. *Telson* longer than wide, cleft to base, lobes apically rounded, with a notch on outer margin near apex bearing 2 spines and a seta between them, a series of submarginal spines on each lobe which are absent in the large ♂♂ from sta. 106.

Antennae in general as in *P. holbölli* (Sars, 1895, pl. 49); antenna 1 with brush of setae on 2nd joint of peduncle, flagellum in ♂ 19-jointed, accessory flagellum 13-jointed; in ♀ similar but more slender, flagellum 15-jointed, accessory flagellum 11-jointed. Antenna 2, upper outer margin of 4th peduncular joint in both sexes

with a comb-like row of 11–12 very stout spines in addition to numerous spine-setae, 5th joint with 3 pairs of similar spines, flagellum in ♂ very long, about 35-jointed, with a few calceoli on basal joints, in ♀ 16-jointed. *Mouth-parts* as in *P. holbölli*, but maxilla 1 with the palp well developed, 2-jointed, extending beyond outer plate. *Gnathopod* 1, 5th joint fusiform, upper margin nearly as long as 6th joint, which is oblong, palm slightly oblique and defined by a notch and a spine. Gnathopod 2 similar but 5th joint more triangular, and 6th joint broader. *Peraeopods* 1–5 very closely resembling those of *P. bassi*, but with stronger spines in addition to the armature of setae, especially on peraeopods 3 and 4. *Uropod* 1, upper margin of peduncle with comb of strong upstanding spines, each ramus with 3–4 short spines on upper margin; uropod 2, upper margin of peduncle and of outer ramus with similar upstanding spines, inner ramus with 2–3 short spines. Uropod 3, peduncle shorter than telson, apex with 4–5 stout spines, rami $2\frac{1}{4}$ times as long as peduncle in ♂, subequal, with plumose setae on all margins, outer margin of outer ramus in addition with a series of notches each bearing 2 short spines; in ♀ unequal, outer ramus scarcely twice length of peduncle, inner subequal to peduncle, outer ramus with spines on outer margin as in ♂ but without any plumose setae, inner ramus bare except for one apical seta, 2nd joint on outer ramus present in both sexes.

Remarks.—This species bears a strong general resemblance to *Phoxocephalus bassi*, but is easily distinguished by the gnathopods and the details of 2nd antenna and the uropods.

TRICHOPHOXUS, n. g.

Like *Phoxocephalus*, but mandible with molar conical, lacking the triturating surface, and tipped with 4 strong spines; and 5th joint of both gnathopods elongate.

Remarks.—But for the difference in the mouth-parts the following species might have been included in the genus *Protophoxus*.

Trichophoxus capillatus, n. sp. (Fig. 13.)

Occurrence.—Sta. 135, New Zealand; 3 ♂♂ 7 mm.

Description ♂.—*Rostrum* extending slightly beyond apex of 1st joint of antenna 1, narrow linguiform, with a few minute submarginal setules on apex. Eyes large, but not contiguous. *Side-plates* 1–4 moderately deep, 4 deeper than long, scarcely excavate on posterior margin; lower margins of all side-plates with numerous setae, long and simple on side-plates 1–4, shorter and plumose on 5–7, the margins of the latter deeply crenulate. *Pleon* segment 3 with postero-inferior angle rounded, crenulate, setose. Pleon segment 4 noticeably elongate. *Telson* longer than wide, cleft to base, lobes subacute, distal margin with 5 notches, each bearing a strong spine.

Antenna 1, 1st joint stout, very little longer than broad, 2nd joint slightly longer than 1st, more slender, with a few long setae on lower margin, flagellum 9-jointed with a large calceolus on each of the basal 5 joints, accessory flagellum 8-jointed.

Antenna 2, 4th joint stout, ovate, with long setae on lower margin and dense fascicles of short setae on upper margin, 5th joint less stout, with short setae and calceoli on upper margin, flagellum about 32-jointed, calceoliferous. *Mouth-parts* as in *Phoxocephalus holbölli*, but molar of mandible developed only as a conical projection as in *Harpinia* and tipped with 4 strong spines. Palp of maxilla 1 1-jointed, well developed. *Gnathopod* 1, 5th joint broadly fusiform, 6th joint shorter than 5th, oblong, front margin with a hump, palm transverse, defined by a small point, a dense brush

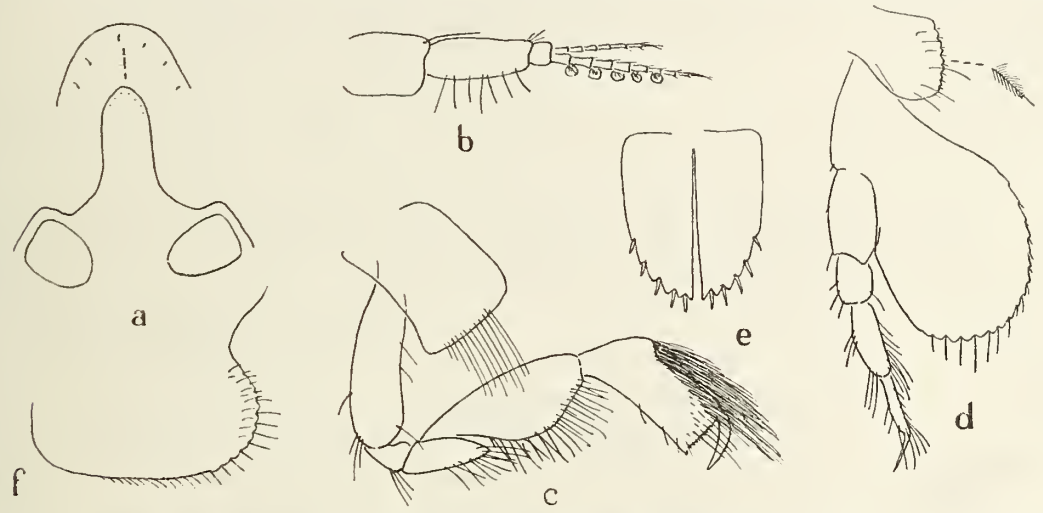

Fig. 13.—*Trichophoxus capillatus*, n. g., n. sp. *a*, dorsal view of rostrum ; *b*, antenna 1 ; *c*, gnathopod 1 ; *d*, peraeopod 5 ; *e*, telson ; *f*, pleon segment 3.

of long simple setae on the front margin distal to the hump. Gnathopod 2 similar to 1 but stouter, and with a stronger projection at angle of palm and hind margin. *Peraeopods* 1 and 2, 2nd–5th joints stout, 4th longer than 5th, 4th strongly setose on hind margin and 5th on hind apex, 6th much more slender. Peraeopods 3 and 4, 2nd joint expanded, ovate, 4th and 5th joints strongly expanded. Peraeopod 5, 2nd joint strongly expanded downwards to about middle of 5th joint, its hind margin serrate, lower margin deeply crenulate. *Uropods* 1 and 2, peduncle and rami with upstanding spines. Uropod 3, peduncle shorter than telson, with apical group of strong spines, rami long, extending well beyond apices of uropods 1 and 2, margins with plumose setae, 2nd joint of outer ramus minute.

Family AMPHILOCHIDAE.

Stebbing, 1906, pp. 148, 723, and 1910, p. 577 ; Schellenberg, 1926, p. 301.

PELTOPES, n. g.

Like *Peltocoxa* but gnathopods 1 and 2 simple, and 2nd joint of peraeopod 3 expanded. Pleon segment 4 produced in a boat-shaped process overlapping segments 5 and 6.

Remarks.—The process on the 4th pleon segment is comparable with that on the

6th pleon segment in *Cyproidea*, and appears to be an attempt to afford extra protection when the pleon is flexed between the 3rd and 4th side-plates.

Peltopes productus, n. sp. (Fig. 14.)

Occurrence.—New Zealand: 1. Sta. 85, 1 ♂, 1 ovigerous ♀ 4 mm. 2. Sta. 133, 10 specimens 2·5–3 mm., of which 1 ovigerous ♀.

Description.—Integument (as preserved) not indurated. *Rostrum* very small. *Side-plates* 3 and 4 concealing 1 and 2, 5 concave on lower margin, 6 and 7 ovoid. *Pleon* segments 1–3 with postero-inferior angles rounded. Pleon segment 4 longest, produced behind into a boat-shaped dorsally concave process overlapping the very short 5th and 6th segments. *Telson* longer than broad, tapering to an acute apex.

Antenna 1 stout, 1st joint equal to 2nd plus 3rd, flagellum equal to 3rd joint, short, triangular, apparently composed of only 1 joint, with long sensory filaments on lower oblique margin, accessory flagellum not observed. Antenna 2 slightly longer than antenna 1, 4th joint a little longer than 5th, flagellum 3-jointed. Palp of *mandible* very slender, 2nd and 3rd joints subequal and longer than 1st. Other mouth-parts similar to those of *Peltocoxa australis*, Brnrd. *Gnathopod* 1 simple, 5th joint rather longer and stouter than 6th which is ovate, tapering to apex, lower margin of 5th and 6th with long spine-setae set mostly in pairs in little notches, finger with 2–3 minute spinules on inner margin. Gnathopod 2 similar to gnathopod 1, but 5th and 6th joints rather more slender and spines on lower margin of 5th joint shorter. *Peraeopods* 1 and 2 moderately stout, anterior margin of 2nd joint setulose, hind margin of 4th–6th joints with a few spinules. Peraeopods 3–5, 2nd joint expanded, distally slightly narrowing in peraeopod 3, but widening in peraeopods 4 and 5, hind margin nearly straight, entire, lower hind apex rounded, 4th joint expanded and decurrent to apex of 5th joint. *Uropod* 1 extending slightly beyond uropod 2 which extends slightly beyond uropod 3, peduncle of uropod 3 and margins of rami of all uropods serrulate, inner ramus of uropod 3 only a trifle over half length of outer ramus.

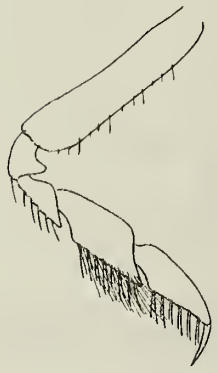

Fig. 14.—*Peltopes productus*, n. g., n. sp., gnathopod 1.

Family LEUCOTHOIDAE.

Stebbing, 1906, p. 161 (part).

Gen. LEUCOTHOE, Leach.

Stebbing, 1906, pp. 163, 724.

Leucothoe spinicarpa (Abildg.).

Chevreux, 1913, p. 108; Barnard, 1916, p. 148; Chilton, 1923, Rec. Austr. Mus. xiv., p. 88; Schellenberg, 1926, p. 308; Monod, 1926, p. 53, fig. 51.

Occurrence.—Sta. 331, Antarctic; 1 ♂ 16 mm.

Distribution.—Cosmopolitan. In the Antarctic regions has been recorded from:

McMurdo Sound, South Orkneys and South Georgia, "Gauss" winter station, Palmer Archipelago, Petermann Island, and Marguerite Bay.

Family SEBIDAE.

Walker, 1907, p. 37.

Gen. SEBA, Bate.

Stebbing, 1906, pp. 162, 724; Walker, 1906, p. 154, and 1907, p. 37; Chilton, 1921 a, p. 56, and 1924, p. 269; Schellenberg, 1926, p. 309.

Seba antarctica, Wlkr.

Walker, 1907, p. 37, pl. 13, fig. 22; Chilton, 1921 a, p. 56.

Occurrence.—Sta. 220, Antarctic; 1 immature ♂, 1 ovigerous ♀ 3·5 mm.

Remarks.—The ♀ carries four very large ova in the brood-pouch (cf. Chilton, 1924, p. 269).

Distribution.—McMurdo Sound.

Family METOPIDAE.

Stebbing, 1906, p. 171.

Gen. PROBOLOIDES, Della Valle.

Stebbing, 1906, pp. 187, 725; Walker, 1907, p. 18; Schellenberg, 1926, p. 323.

Schellenberg sinks *Proboliella*, Wlkr., with its single species *typica*, Wlkr., as a synonym of this genus. The only distinguishing feature of *Proboliella* was a 2-jointed mandibular palp, and Schellenberg found specimens with 3-jointed palps, otherwise agreeing perfectly with *typica*. Schellenberg's findings are here confirmed.

Proboloides typica (Wlkr.).

Walker, 1907, p. 20, pl. 6, fig. 10; Schellenberg, 1926, p. 323, fig. 41.

Occurrence.—Sta. 331, Antarctic; 7 specimens 3–3·5 mm., including 1 ovigerous ♀.

Remarks.—The 3rd joint of the mandibular palp is developed as in Schellenberg's figure.

Distribution.—McMurdo Sound; "Gauss" winter quarters.

Proboloides perlatus, n. sp. (Fig. 15.)

? Walker, 1907, p. 18, pl. 5, fig. 9 (♂) (*antarcticus* part ♂).

Occurrence.—Sta. 220, Antarctic; 1 ♂ 10 mm., 2 ♀♀ 10 mm., 4 juv. 6–8 mm.

Description.—No dorsal carination. *Eyes* well developed, round, about 21 ocelli, pale (as preserved). *Side-plate* 3, lower margin with a series of submarginal ovoid, semicircular or triangular denticles, which give the margin a crenulated or beaded

appearance when the side-plate is viewed obliquely from above. This feature does not occur on any of the other side-plates. Postero-inferior angle of *pleon* segment 3 quadrate. *Telson* oval, apically rounded, 3 submarginal spinules laterally, and one median near apex.

Antenna 1 without accessory flagellum. Antenna 2 about half length of antenna 1. Palp of *mandible* 3-jointed, 3rd joint short but distinct. Palp of *maxilla* 1 2-jointed. Inner plates of maxilliped separate, apically truncate. *Gnathopod* 1, 4th joint prominently projecting, strongly setose and with thick brush of short setules, 5th joint elongate, tapering distally, strongly setose, 6th joint a little shorter than 5th, front

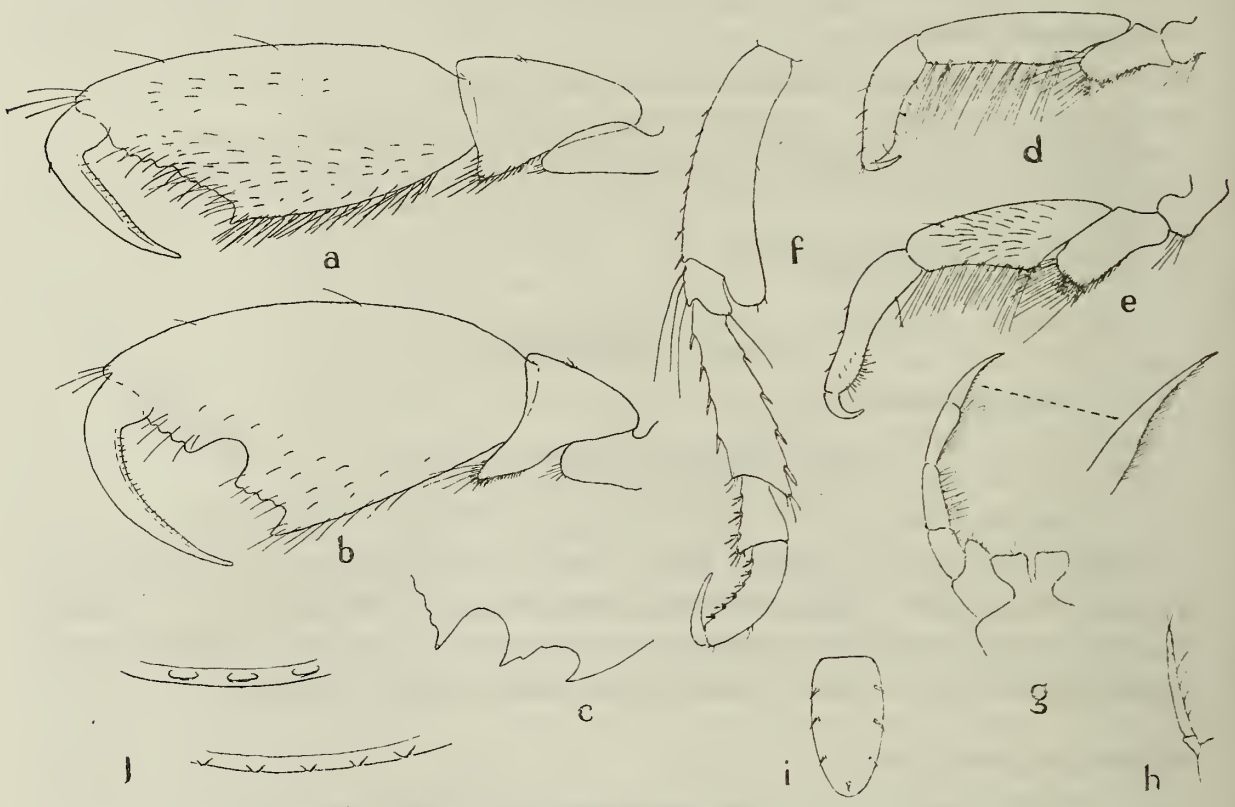

FIG. 15.—*Proboloides perlatus*, n. sp. *a*, gnathopod 2 of young, and of immature ♀; *b*, of adult ♂; *c*, palm of hand of gnathopod 2 of ♂; *d*, *e*, two forms of gnathopod 1 of ♀; *f*, peraeopod 3; *g*, maxilliped; *h*, palp of mandible; *i*, telson; *j*, two forms of ornamentation of lower margin of side-plate 3.

margin convex proximally, lower margin sinuous, convex distally but without any defined palm, 7th joint strongly curved. In other specimens and in the young the 6th joint is distinctly shorter than 5th, and of a more evenly cylindrical shape. Gnathopod 2, 6th joint ovate, palm oblique, well defined, with rounded teeth in two sets of 4 separated by a semicircular gap which is variable in size, palmar tooth strong; the palmar gap is small in the gnathopod of both sides in the one ♀ and 3 largest juv. and in the left gnathopod of the other ♀; in the right gnathopod of the latter and both gnathopods of the smallest juv. the gap is larger. In the ♂ the teeth immediately adjoining the gap are larger. *Peraeopod* 3, 2nd joint narrow but expanding distally

into a rounded lobe extending almost to end of 3rd joint, 4th joint feebly expanded and decurrent distally. Peraeopods 4 and 5, 2nd joint expanded, oval, hind margin gently convex, entire, smooth, 4th joint slightly more expanded and decurrent than in peraeopod 3. *Uropod* 3, peduncle a little longer than 1st joint of ramus, which is a little longer than the 2nd joint, both peduncle and ramus unarmed like uropods 1 and 2.

Remarks.—The elongate 5th and the peculiar shape of the 6th joint of gnathopod 1 are distinctive, though in *gregaria* the 6th joint is somewhat similar, but the 5th joint is not nearly so elongate. An elongate 5th joint in gnathopod 1 is found in *Prometopa tuberculata*, Schell., a species which in other respects bears no resemblance to the present species.

In spite of the greater relative shortness of the 5th and 6th (especially the 5th) in Walker's fig. 9, gn. 1 ♂, and the absence of serrations on side-plate 2, one has a suspicion that the ♂ of *antarcticus* described by Walker is really the same as the present specimens. The figure of the ♂ gnathopod 2 with the excavate palm (labelled in error gn. 2 ♀) corresponds very closely with the present ♂ specimen. Walker, however, makes no mention of any ornamentation on the 3rd side-plate, which is such an obvious and distinctive feature of the "Terra Nova" specimens. It may be noted that a similar ornamentation occurs also in *Stenothoe ornata* (*see infra*).

Family STENOTHOIDAE.

Stebbing, 1906, pp. 192, 725.

Gen. STENOTHOE, Dana.

Stebbing, 1906, pp. 192, 725; Barnard, 1916, p. 153.

Stenothoe ornata, n. sp. (Fig. 16.)

Occurrence.—Sta. 136, New Zealand; 1 ♂ 6 mm.

Description.—*Back* not carinate. Whole lower margin of *side-plate* 3 and anterior part of lower margin of side-plate 4 with a series of submarginal denticles (cf. *Proboloides perlatus*). Postero-inferior angles of *pleon* segment 3 subacute. *Gnathopod* 1, 2nd joint straight, 4th produced. Gnathopod 2, lower margin of 4th joint smooth, 6th ovate, palm straight, furry, near hinge an acute tooth pointing distally, separated by a narrow notch from a short square tooth, finger setulose on inner margin distally. *Peraeopod* 3, 2nd joint not expanded. Peraeopods 3–5, 4th joint expanded and decurrent. *Uropod* 3, ramus shorter than peduncle, 2nd joint straight.

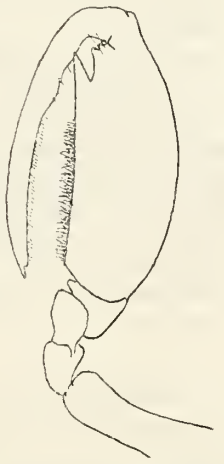

Fig. 16.—*Stenothoe ornata*, n. sp., gnathopod 2.

Remarks.—It is quite possible that this is Haswell's *miersii*, a species which Stebbing stated (1910, p. 637) was still obscure; and also Stephensen's *aucklandicus* which was described from the ♀ only (1927, p. 311).

The ornamentation of the 3rd and 4th side-plates appears to be distinctive, though the hand of gnathopod 2 bears some resemblance to that of *gallensis*, Wlkr.

Family LAFYSTIIDAE.

Stebbing, 1906, p. 208, and p. 209. (*Laphystiopsidae.*)

The following form combines in such a remarkable manner the characters of the two families *Lafystiidae* and *Laphystiopsidae* that it seems to me necessary to withdraw the latter family and revert to the arrangement of Sars (1895), who included both *Lafystius* and *Laphystiopsis* in one family.

PROLAPHYSTIUS, n. g.

The diagnosis will be clear from the following tabular arrangement of its characters ranged alongside those of the other two genera:

Lafystius	*Laphystiopsis*	*Prolaphystius*
rostrum present	rostrum present	rostrum absent
side-plates 1–4 deep	shallow	deep (moderately)
eyes distinct	rudimentary	absent (invisible)
antenna 1 stout	slender	stout (moderately)
upper lip entire	incised	incised
lower lip without inner lobes	with small inner lobes	without inner lobes
mandible without molar	with weak conical molar	with molar well developed
palp of maxilla 1 rudimentary, nodiform	large, 1-jointed	large, 2-jointed
maxilliped with inner plate long	short	short
outer plate large	moderate	moderate
palp 2-jointed, short	4-jointed, long	4-jointed, short
gnathopod 1 simple gnathopod 2 subchelate	simple, similar	simple, but gn. 2 more elongate than gn. 1
peraeopods 1, 2 stout, alike	stout, alike	prp. 1 slender, 2 stout
peraeopods 3–5 stout, alike	slender, 5 longer than others	stout, alike
telson shortly oval	shortly oval	elongate, linguiform
pleon segment 3 dorsally scarcely produced	produced in a short compressed gibbous projection	produced in a broad shovel-like horizontal process

Remarks.—One curious feature of this genus is the dissimilarity of peraeopods 1 and 2 and the similarity of the latter to the succeeding peraeopods 3–5 as regards the stoutness of the 3rd–7th joints.

Prolaphystius isopodops, n. sp. (Figs. 17–19.)

Occurrence.—Sta. 314, Antarctic; 1 ♀ with embryos 9 mm.

Description.—Integument not strongly indurated, minutely scabrous. The scabrous sculpturing extends over the whole body, telson, uropods, and peraeopods. *Body* depressed, back broad, smooth. *Head* without any rostral point, antero-lateral angles quadrate. No trace of eyes. Postero-inferior angles of segments 1–4 rounded, 5–7 quadrate. Side-plates 1–4 deep, 1 oblong, 2 and 3 curving slightly backwards, postero-inferior angles slightly pointed, 4 with anterior margin strongly convex, forming with the straight postero-inferior margin a slightly obtuse angle; posterior

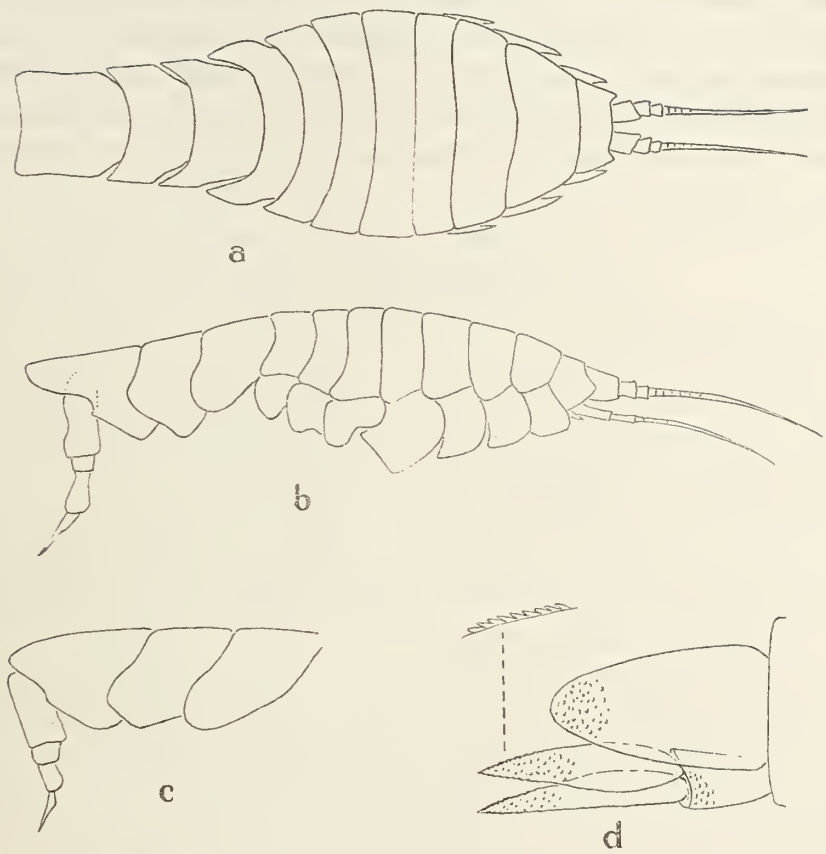

Fig. 17.—*Prolaphystius isopodops* n. g., n. sp. *a, b,* dorsal and lateral views of ♀; *c,* pleon of young from brood pouch; *d,* telson and uropod 3 (sculpturing only partially indicated).

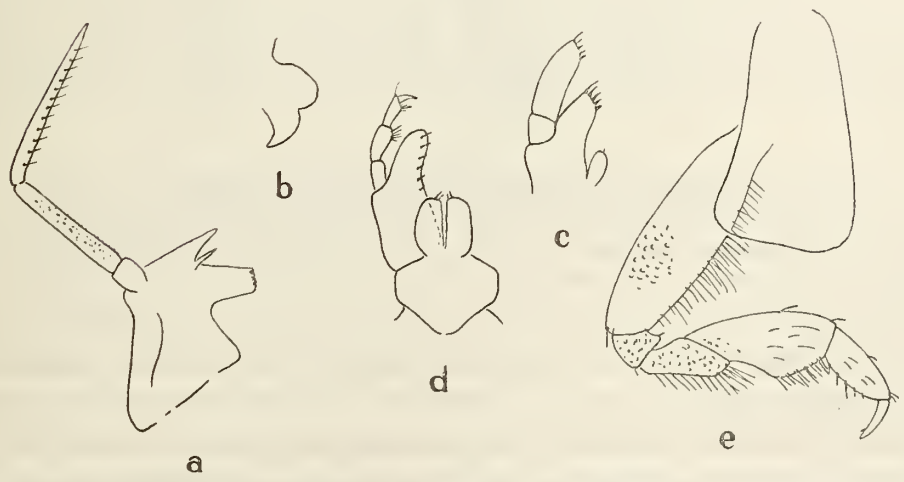

Fig. 18.—*Prolaphystius isopodops*, n. g., n. sp. *a,* mandible; *b,* lateral view of epistome and upper lip; *c,* maxilla 1; *d,* maxilliped; *e,* gnathopod 1 with side-plate (sculpturing only partially indicated).

lobes of 5 and 6 rounded, 7 rounded. *Pleon* segments 1–3 longer than any of the peraeon segments, the 3rd produced backwards in a truncate shovel-like process overhanging the base of segment 4, segments 4–6 slender and weak compared with segments 1–3, 4 gibbous basally and distally, with a transverse depression between, 5 short; postero-inferior margin of segment 1 rounded, of 2 oblique, postero-lateral margin

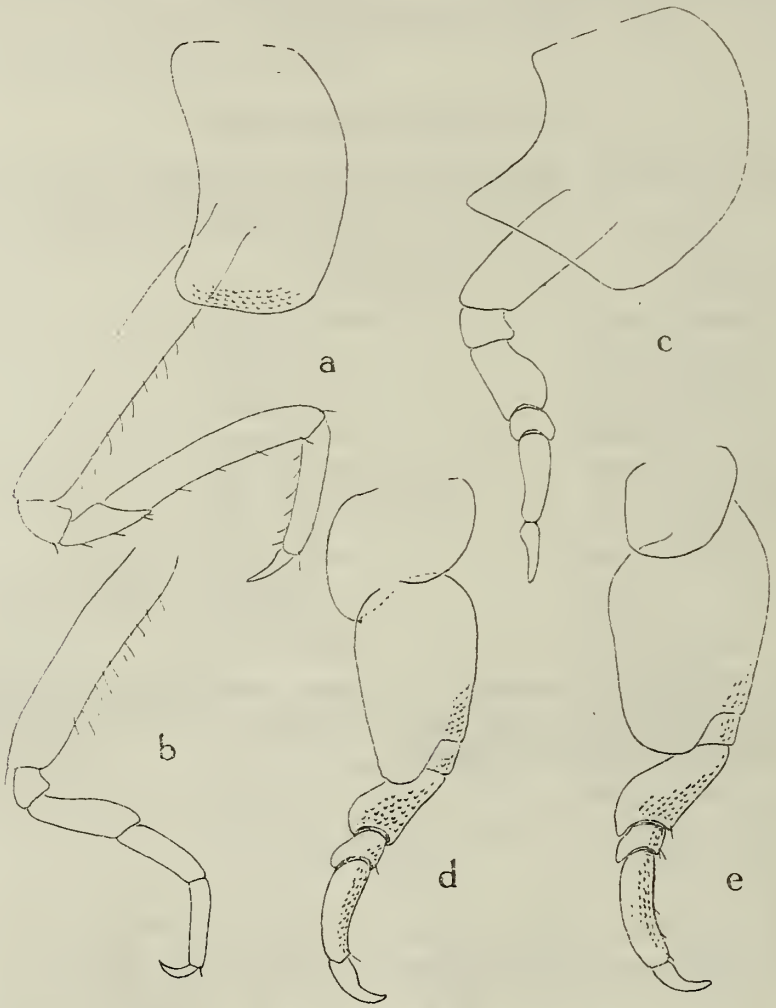

Fig. 19.—*Prolaphystius isopodops*, n. g., n. sp. *a*, gnathopod 2; *b*, peraeopod 1; *c*, peraeopod 2; *d*, peraeopod 3; *e*, peraeopod 5 (sculpturing only partially indicated).

of 3 very oblique with a small point in the middle probably representing the postero-inferior angle. *Telson* rather elongate, linguiform, apex rounded, smooth, basally concave on dorsal surface.

Antenna 1, peduncle stout, 1st joint scarcely longer than broad, 2nd and 3rd broader than long, flagellum at least 8-jointed (apex broken off), sparsely setulose, no accessory flagellum. Antenna 2 shorter and more slender than antenna 1, 1st joint fairly stout, 2nd and 3rd short, 4th a little longer than 3rd, 5th a little longer than 4th,

flagellum at least 10-jointed (apex lost), sparsely setulose. *Epistome* gibbous, prominently projecting; upper lip apically incised. *Mandible* stout, cutting edge and secondary cutting edge dentate, no spine-row, molar strong, denticulate, palp elongate, slender, 3rd joint longer than 2nd. Lower lip broad, inner lobes obsolete. *Maxilla* 1, outer plate with 6–7 apical spines, inner plate feeble with 1 apical seta, palp well developed, 2-jointed. Maxilla 2 as in *Laphystiopsis* (Sars, pl. 135). *Maxilliped*, inner plate rather short, ovate, outer plate larger than in *Laphystiopsis*, but not so large as in *Lafystius*, palp short and feeble, but 4-jointed.

Gnathopod 1 simple, 2nd joint fusiform, 5th trapezoidal, longer than 4th, lower distal margin with rather strong spine-setae, 6th shorter than 5th, ovate, tapering. Gnathopod 2 simple, but much longer and more slender than gnathopod 1, 2nd joint linear, 5th and 6th linear, the latter shorter than the former, lower margins with a few setules. *Peraeopod* 1 slender, not as long as gnathopod 2, 4th joint slightly longer than 5th and 6th, which are subequal, dactylus slender as in gnathopods 1 and 2. Peraeopod 2 unlike peraeopod 1 and resembling peraeopods 3–5, stout, 2nd joint linear but stout, 4th somewhat flask-shaped, 5th very short, 6th a little longer than 4th, dactylus stout. Peraeopods 3–5 stout, subequal in length, 2nd joint ovate, broader in peraeopod 5 than in peraeopods 3 and 4, lower hind corner produced in a rounded lobe extending beyond end of 3rd joint, 4th flask-shaped, slightly decurrent posteriorly in peraeopod 5, but not in 3 and 4, 6th a little longer than 4th, dactylus stout. *Uropods* 1 and 2, peduncle longer than the narrow lanceolate rami, of which outer is a trifle longer than inner. *Uropod* 3, peduncle about half length of the lanceolate rami, of which outer is a trifle longer than inner. Margins of the rami of all the uropods, especially of uropod 3, minutely and regularly serrulate.

In the young taken from the brood-pouch there is also no trace of eyes. The pleon is sharply bent between the 3rd and 4th segments, but the projection on the 3rd is not yet developed.

Remarks.—In dorsal view this animal bears a striking resemblance to some forms of *Idotea* (*Isopoda*), though of course the segmentation of the pleon is obviously different.

Family ACANTHONOTOZOMATIDAE.

Stebbing, 1906, p. 210, and 1910, p. 584; Chevreux, 1906, p. 38 (new genus), and 1913, p. 114; Kunkel, 1910, Tr. Conn. Ac. Sci. XVI., p. 23 (new genus); Schellenberg, 1926, p. 327 (new genus).

The variations in the mouth-parts, in particular the palp of maxilla 1, have been mainly responsible in the past for the institution of several closely allied genera in this family. On the same principle further types of maxillary palps and of mandibles, exhibited by specimens in the "Terra Nova" collection, render four new genera necessary.

If the shape of the side-plates also were taken into account a multitude of genera,

mostly monotypic, might be instituted; e.g. compare the pairs of species in the genera *Iphimediella* and *Gnathiphimedia* (*infra*). In certain cases, however, there seems to be some variation in the side-plates, and I think that in any case the mouth-parts are a surer indication of differing habits and physiological constitution; consequently the latter have been made the basic features of the new genera.

If the present lines of generic division be accepted, the genus *Iphimedia* will become confined to the northern hemisphere, with the exception of the Australian *I. discreta* (omitting *ambigua* and *stimpsoni* as doubtful). *I. serrata*, Schell., 1926, will prove in all probability to be an *Iphimediella*.

The discovery of several species of these magnificent Amphipods is a tribute to the energy of the "Terra Nova" naturalists. A further increase in the number of species is not too much to expect when other parts of the Antarctic coast-line shall have been investigated thoroughly.

Gen. ACANTHONOTOZOMELLA, Schell.

Schellenberg, 1926, p. 332.

This genus differs from *Acanthonotozoma* only in having the 1st and 2nd gnathopods alike, the 1st not particularly slender. The greater breadth of the 1st–3rd side-plates should not be included as part of the generic diagnosis, otherwise the present n. sp. will be excluded.

In addition to the genotype *alata*, Schell., *australis*, Chilton, should be transferred to this genus. The present new species differs from both, and also from the species of *Acanthonotozoma*, in having no *medio*-dorsal carination or armature on the *peraeon*.

Acanthonotozomella oatesi, n. sp. (Figs. 20, 21.)

Occurrence.—Sta. 220, Antarctic; 2 ovigerous ♀♀ 10 and 11 mm.

Description.—*Rostrum* strong, porrect, slightly deflexed. Lateral margin of *head* with antero-inferior corner produced in a narrow spinous process. *Eyes* well developed, prominent, dark red. *Peraeon* segments 1–7 and *pleon* segments 1–4 each with a pair of subdorsal upstanding processes, more or less curving backwards, and serrated on their upper (anterior) margins. On both pleon segments 3 and 4 there is in addition a medio-dorsal process. The lower margin of each peraeon segment is produced into a horizontally projecting, backwardly curving process; and this line of processes is continued by a similar process arising in the middle of the side of each of the pleon segments 1–3. *Side-plates* 1 and 2 narrow, pointed below, curving gently backwards; side-plate 3 similar but proximal half broader, the distal half being abruptly narrower; side-plate 4 rather broad in its basal half, distally deeply bifid; side-plate 5 longer than deep; side-plate 6 about as deep as long; 5 and 6 each with a strong outwardly and backwardly curving process, postero-inferior angles rounded: side-plate 7 unarmed, postero-inferior angle quadrate with a small point. Postero-inferior angle of pleon

segment 1 with a small point, of segment 2 with a stronger point, and of segment 3 produced in a long curved process. Pleon segment 5 smooth ; segment 6 with a small upstanding tooth on either side of base of *telson*, which is short, ovate, apically entire.

Antenna 1, 1st joint stout, not quite as long as rostrum, upper apex produced in two spinous processes, lower margin with one spinous process near base, tipped with setae, and a larger one at apex ; 2nd joint shorter than 1st, its upper apex produced in 2 teeth, the outer smaller than the inner ; 3rd joint short, unarmed ; flagellum about twice as long as peduncle. Antenna 2 about twice as long as antenna 1, 2nd joint with 2 teeth on its upper apex, outer smaller than inner ; 3rd joint with 1 tooth on upper apex ; 4th joint with 2 teeth on upper, and 1 on lower, apex ; 5th joint unarmed, shorter than 4th. *Mouth-parts* in general like those figured for *Acanthonotozoma* by

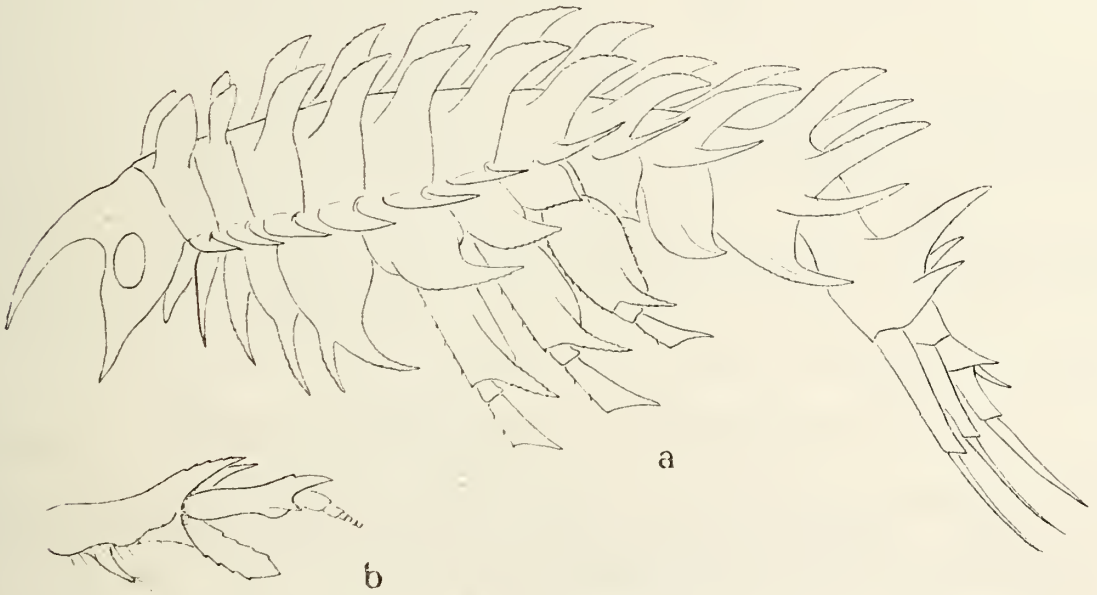

Fig. 20.—*Acanthonotozomella oatesi*, n. sp. *a*, general view ; *b*, outer view of right antenna 1.

Sars (1895, pl. 131). Upper lip elongate, apex minutely incised. Mandible elongate, slender, cutting-edge very short, dentate, apparently no secondary cutting plate, spine-row of about 8 spinules, molar obsolete, palp slender, 1st joint short, 2nd very elongate, about as long as trunk of mandible, 3rd a little shorter than 2nd. Maxillae 1 and 2 as figured by Sars, except that inner plate of maxilla 1 is very small and oval. Maxilliped as figured by Sars, outer plate apically rounded, with submarginal row of setae, but palp stout, especially the 1st and 2nd joints. *Gnathopod* 1 not feeble, 2nd joint more elongate than in Sars' figure, 5th joint $\frac{3}{4}$ length of 2nd, nearly as thick, lower (hind) margin with groups of spine-setae, 6th joint $\frac{2}{3}$ length of 5th, also with spine-setae, dactylus strong with 6 spines on lower margin. Gnathopod 2 similar to gnathopod 1 but larger. *Peraeopods* 3–5, 2nd joints oblong, on peraeopod 5 ovate, wider basally, margins entire with a few setules, each with a longitudinal central keel which is decurrent into a strong outstanding backwardly directed spinous process ; 4th joints posteriorly

decurrent into sharp points. Distal joints of peraeopods 1–5 broken off. *Uropods* with the inner and outer rami subequal, slender, elongate, tapering to fine points, their margins (under high magnification) regularly and minutely serrate, the inner margin of outer ramus of uropod 3 with a few short stout spines at intervals.

Remarks.—The general aspect of this species bears a curiously close resemblance to that of *Paramphithoe hystrix* (Family *Paramphithoidae*) figured by Sars (1895, pl. 130) under the name *Acanthozone cuspidata*, except that the latter has medio-dorsal processes flanked by smaller subdorsal processes. But the lateral horizontal processes, the bifid 4th side-plate, and the processiferous 5th and 6th side-plates serve to distinguish it. There is also a resemblance to *Actinacanthus tricarinatus* (Stebb.) (also Family

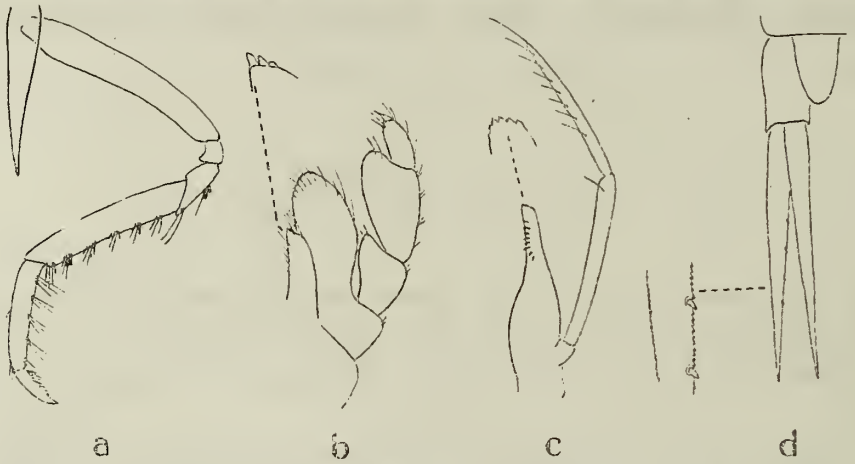

Fig. 21.—*Acanthonotozomella oatesi*, n. sp. *a*, gnathopod 1; *b*, maxilliped; *c*, mandible; *d*, telson and uropod 3.

Paramphithoidae), especially in the antennae. The mouth-parts, however, at once show that this species belongs to the *Acanthonotozomatidae*.

Named in honour of "The very gallant gentleman."

Gen. IPHIMEDIELLA, Chevr.

Chevreux, 1913, p. 119.

Diagnosis.—Epistome moderate or rather long, gibbous proximally. Upper lip entire or feebly incised. Mandible tapering to a single or bidentate apex, secondary cutting plate (if present) in left only, molar feeble, spine-row absent. Palp of maxilla 1 as in *Iphimedia*. Maxilliped with 2nd joint of palp not produced along inner margin of 3rd joint.

Iphimediella margueritei, Chevr. (Fig. 22.)

Chevreux, 1913, p. 120, figs. 22–24; Schellenberg, 1926, p. 329, fig. 44. (*Iphimedia microdentata*.)

Occurrence.—Antarctic: 1. Sta. 314, 1 ♂ 17 mm. 2. Sta. 316, 1 ♀ 23 mm. 3. Sta. 338, 1 ♀ 22 mm. 4. Sta. 339, 3 ♀♀ 21–23 mm.

Remarks.—These specimens show some slight variations from the specimens described by Chevreux. *No.* 2. Side-plates 1–3, especially 1st, stouter and less tapering

below, 1st and 3rd distally truncate, with 2 minute denticles on the concave margin between the antero- and postero-inferior angles. Postero-inferior angle of side-plate 5 is quadrate with a small point like the 6th side-plate. *No.* 3. Side-plates 1–3 as in the typical specimens. Postero-inferior angle of side-plate 6, as well as that of 5, rounded. Peraeopods 1–5 longer and more slender than in Chevreux's figures, especially the 6th joints of peraeopods 3–5. Lateral margin of head with less prominent points and a wider notch between them. *No.* 1. Side-plates 1–3 as in No. 2. Side-plates 5 and 6 typical. *No.* 4. In one specimen side-plates 1–3 as in No. 2, in another transitional between this and the typical form, and in the third specimen nearly typical. The *epistome* (not described by Chevreux) is not so long as in the next species, and is slightly bulbous proximally. There is a slight variation in the specimens as shown in fig. 22, *b*. The *eyes* of the ♂ are certainly larger than those of the ♀, but the latter are not so small as represented in Chevreux's figure, consequently the sexual difference is not so marked.

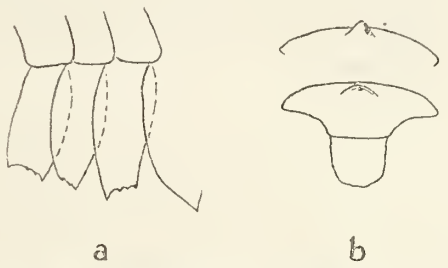

Fig. 22.—*Iphimediella margueritei*, Chevr. *a*, side-plates 1–3 of specimen from station 316; *b*, epistome (two varieties).

The variation in the present specimens seems to necessitate the withdrawal of *microdentata* as a separate species.

Distribution.—Near Graham Land, 200 metres; "Gauss" winter station, 385 metres.

Iphimediella cyclogena, n. sp. (Fig. 23.)

Occurrence.—Antarctic: 1. Sta. 194, 2 ♂♂ 34 and 40 mm., 1 ♀ 37 mm. 2. Sta. 316, 2 ♂♂ 36 and 43 mm., 2 ♀♀ 26 and 48 mm. (the larger ovigerous). Types.

Description.—Lateral margin of *head* produced into an upper sharp point and a lower rounded lobe separated by a narrow notch. *Peraeon* segment 7 and pleon segments 1–3 each with 2 dorsal processes. Postero-inferior angles of segments 1–4 rounded, of segments 5–7 slightly produced into points. *Side-plate* 1 oblong, 2, 3 and 4 pointed below, with very faint serrations on lower anterior margins. Antero-inferior angles of the posterior lobes of side-plates 5 and 6 rounded; postero-inferior angles of 5–7 quadrate. None of the *pleon* segments dorsally carinate. Postero-inferior angle of segment 1 quadrate, of segment 2 with a small point, of segment 3 with a strong point. The middle of the lateral margins of segments 1 and 2 with small points, of segment 3 with a strong spinous process. *Telson* not so narrowly incised as in *margueritei*.

Antenna 1, 1st joint much stouter than following joints, as long as 2nd and 3rd together, 2–3 knobs at base on lower margin, lower apex produced in a long stout spine extending to end of the spines on 2nd joint, with a tooth on its anterior margin near base; 2nd joint twice length of 3rd, its upper and lower apices produced as spines. Antenna 2 about as long as antenna 1, similar to that of *G. pacifica* (*infra*), but the

tooth on the ventro-lateral margin of 2nd joint is not apically bifid and its margins are serrulate, upper and lower apices of 4th joint produced as short spines. *Mouth-parts* in general like those of *margueritei*. Epistome produced downwards, gibbous proximally. Upper lip feebly incised. Mandible stout at base, tapering to a thin subacute, strongly chitinised apex, secondary cutting plate in left mandible narrow, strongly chitinised, molar a thin transparent fixed triangular projection. *Peraeopods* 1 and 2, 4th joint not strongly decurrent, hind margins of 4th, 5th and 6th joints with short stout spines set in transverse rows. Peraeopods 3–5 as in *margueritei*, 4th joints decurrent.

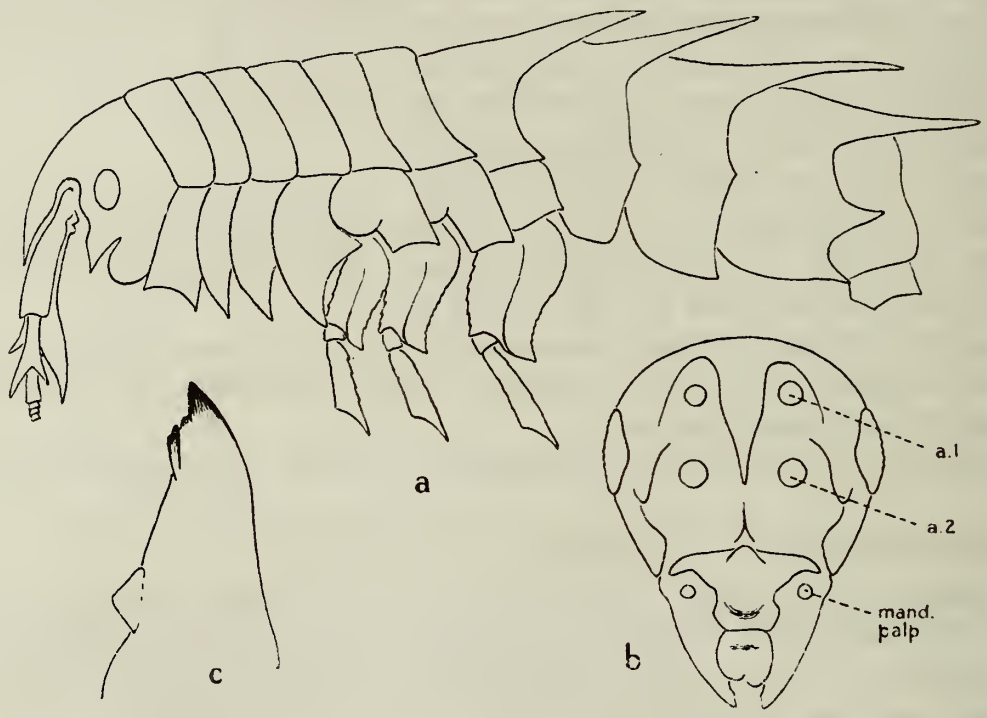

Fig. 23.—*Iphimediella cyclogena*, n. sp. *a*, general view (6th pleon segment, telson and uropods omitted); *b*, semi-diagrammatic view of front of head; *c*, left mandible (palp omitted).

The ♂ does not differ from the ♀ except in the narrower peraeon; the eye is not appreciably larger.

Remarks.—In the possession of four pairs of dorsal processes this species comes very close to *margueritei*. In fact the discovery of the form described as *microdentata* and other varietal forms with truncate and excavate 1st side-plate in the "Terra Nova" collection would justify one in regarding these specimens as *margueritei* but for the broadly rounded lower angle of the head. This feature is absolutely constant in the specimens at hand, and there is no hint of possible transitional forms. Nor can this species be regarded as the fully-grown adult of *margueritei*, owing to the constancy of the 1st–3rd side-plates. One would not expect to find these variable in the young and half-grown, and becoming stereotyped in the adult.

Iphimediella brevispinosa, n. sp. (Fig. 24.)

Occurrence.—Antarctic: 1. Sta. 314, 1 ovigerous ♀ 28 mm. 2. Sta. 339, 1 ♂ 16 mm., 4 ♀♀ 22, 25, 26, 28 mm. (the largest ovigerous). Types.

Description.—Similar to *cyclogena* with the following differences. Lateral margin of *head* with two sharp points separated by a narrow notch; the lower point not longer than the upper, thus differing from *margueritei*. Dorsal processes on *peraeon* segment 7 and *pleon* segments 1–3 much shorter, extending only slightly, if at all, beyond the middle of the succeeding segments, curved downwards and thus lying more closely adpressed to the body. *Side-plate* 1 with the antero-inferior angle rounded. *Antenna* 1, 1st joint not much longer than 2nd and 3rd together, apex with two small teeth as well as the long spinous tooth which reaches to apex of 2nd joint. Antenna 2 with lower inner tooth on margin of 2nd joint bifid. Epistome as in *margueritei*.

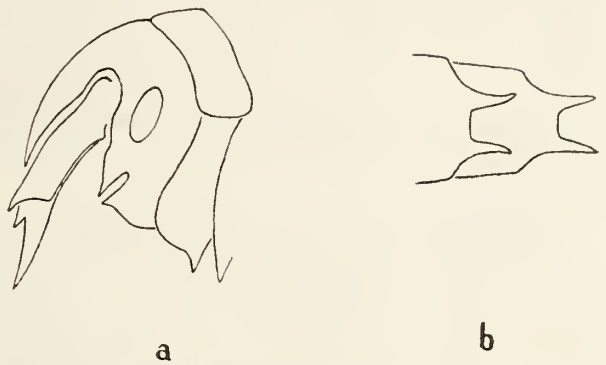

Fig. 24.—*Iphimediella brevispinosa*, n. sp. *a*, head; *b*, dorsal view of pleon segments 1 and 2.

The ♂ does not differ from the ♀.

Remarks.—The shorter dorsal processes, 1st side-plate, and equal length of the two sharp points on the lateral margin of head serve to distinguish this species from *margueritei* and *cyclogena*.

Iphimediella rigida, n. sp. (Fig. 25.)

Occurrence.—Sta. 339, Antarctic; 1 ♂ 32 mm.

Description.—Very close to *brevispinosa* but larger and differing as follows. The *dorsal processes* are similar to those of *brevispinosa* but closer together, the gap between the two processes of each pair being V-shaped instead of U-shaped; and in addition pleon segments 1–4 are dorsally carinate, the carina on segments 1–3 being in lateral view long and gently convex, but on segment 4 raised up into a triangular point. *Antenna* 1, on the 1st joint there is only one small tooth on anterior margin of the long spinous tooth, which reaches to apex of 3rd joint. Upper lip feebly incised.

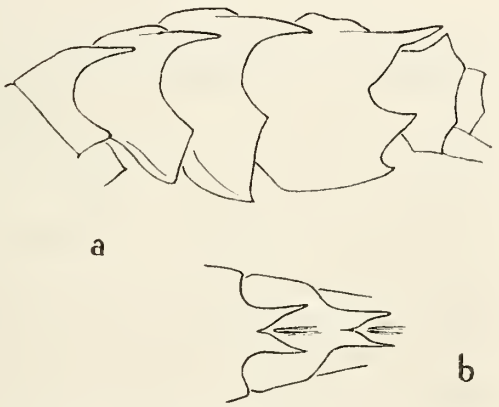

Fig. 25.—*Iphimediella rigida*, n. sp. *a*, lateral view of peraeon segment 7 and pleon segments 1–5; *b*, dorsal view of peraeon segment 7 and pleon segment 1.

Remarks.—The fact that in the species here examined the ♂ does not differ from the ♀, and moreover that well-marked sexual differences are not found in any of the other members of this family, seems to exclude the possibility of this single specimen being the adult ♂ of *brevispinosa*.

When the pleon is extended the dorsal carinae fit in between the dorsal processes and give extra rigidity to the hinder half of the body.

GNATHIPHIMEDIA, n. g.

Diagnosis.—Resembling *Iphimediella* except that the epistome is wide and very short, and the mandibles are very short and stout, with the apices transformed (in the adult) into broad oval grinding surfaces.

Remarks.—Sars (1895, p. 372) refers to the projecting mouth-parts of the members of this family as indicating parasitic or semi-parasitic modes of life, and mentions that *Panoploea eblanae* is known to be parasitic in jelly-fishes. The two species following hereon mark a departure from the presumably normal habits of the members of the family, and as an alteration in the shape of the "face" as well as the shortening of the mandibles is involved (cf. figs. 23 *b* and 26 *b*), I consider that they deserve generic recognition. In the second species, *pacifica*, the grinding surfaces of the mandibles have not reached such an extreme degree of flattening as in the genotype *mandibularis*.

A curious parallelism between the two species of this genus and the two species of *Iphimediella* as regards the shape of the side-plates may be noted. *G. pacifica* (as here described) pairs with *I. margueritei* in having the three anterior side-plates tapering below and curving forwards; *G. mandibularis* pairs with *I. cyclogena* in having the 1st side-plate not tapering below, and the 2nd and 3rd side-plates curving backwards.

Gnathiphimedia mandibularis, n. sp. (Fig. 26.)

Occurrence.—ANTARCTIC: 1. Sta. 316, 1 ♂ 29 mm., 2 ♀♀ 31 and 36 mm. (the larger with embryos). 2. Sta. 194, 3 ♀♀ 27, 31, 42 mm. (the largest spent). 3. Sta. 355, 4 ♂♂ 24, 27, 30, 35 mm., 5 ♀♀ 25, 29, 33, 37, 40 mm. (the 37 mm. one ovigerous, the 40 mm. one with embryos. Types. 4. Sta. 355, 2 ♂♂ 29 and 36 mm.

Description.—Similar to *I. cyclogena* but with the following differences. Lateral margin of *head* produced into two sharp points separated by a rather wide notch. *Rostrum* broader at base. Dorsal processes on 3rd *pleon* segment slightly upturned. *Side-plate* 1 narrower than in *cyclogena*, with antero-inferior angle rounded. *Antenna* 1, 1st joint twice as long as 2nd and 3rd together, a strong knob on lower margin, lower apex produced in a long stout spine extending beyond 3rd joint, with a tooth on its anterior margin near base, 2nd joint twice 3rd, its upper apex well produced as a spine, but its lower apex only very shortly produced. *Mouth-parts* not prominently projecting. Epistome wide and very short. Upper lip short, apically entire, strongly gibbous. Mandible short and very strong, the cutting edge transformed into a broad, ovate, heavily chitinised grinding surface, secondary plate small, thin, but strongly chitinised,

sometimes absent, the true molar tubercle reduced to a small, thin, movable lamina (possibly this structure represents not the molar, but the fused spines of the spine-row).

There is no difference between the ♂ and the ♀ except the narrower peraeon in the ♂; the eye is not appreciably larger than in ♀. The young taken from the brood-pouch of the largest ♀ in No. 3, and measuring 7 mm. in length, do not differ essentially from the adult. The dorsal spines are shorter and lie flatter upon the body. Side-plates 2–4 are rather less sharply pointed. The spine on 1st joint of antenna 1 does not extend beyond apex of 2nd joint. The mouth-parts correspond with those of the adult, except that the mandible has a bluntly pointed apex, and the secondary plate is relatively better developed.

Remarks.—The close resemblance this species bears to *I. cyclogena* is only less

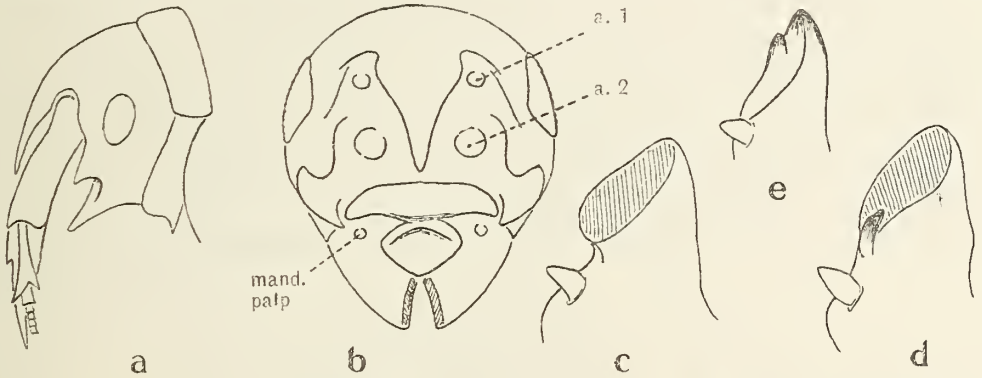

Fig. 26.—*Gnathiphimedia mandibularis*, n. g., n. sp. *a*, head and first side-plate; *b*, semi-diagrammatic front view of head; *c*, left mandible (station 194); *d*, left mandible (station 355); *e*, left mandible of young from station 355 (in *c* and *d* the grinding surface is shaded).

remarkable than the extraordinary differences in the epistome and mandibles. Evidently the food of the two species is quite different.

Gnathiphimedia pacifica (Stebb.). (Fig. 27.)

Stebbing, 1888, p. 890, pl. 71; Walker, 1907, p. 27; Chevreux, 1913, p. 113; Schellenberg, 1926, p. 331. (*Iphimediella sexdentata*).

Occurrence.—Antarctic: 1. Sta. 314, 3 ♀♀ 18, 23, 25 mm. (the largest ovigerous). 2. Sta. 316, 1 ♂ 21 mm., 2 ♀♀ 24 mm. (one ovigerous, the other spent). 3. Sta. 331, 1 ♀ 12 mm. 4. Sta. 338, 2 ♀♀ 18 mm. 5. Sta. 339, 2 ♂♂ 16 mm., 3 ♀♀ 19, 20, 23 mm. (the largest ovigerous). 6. Sta. 355, 1 ♂ 18 mm., 3 ♀♀ 18, 20, 25 mm., 1 ovigerous ♀ 19 mm., 1 ♀ with embryos 25 mm.

Description.—Postero-inferior angles of *peraeon* segments are quadrate, only those of segments 5–7 slightly produced backwards as sharp points; in the two smaller ♀♀ of No. 5 these are more pronounced than usual, but not nearly so prominent as in Stebbing's specimens. *Side-plates* closely resembling those of *I. margueritei*, i.e. 1–3

curve forwards and not backwards, though in some cases the anterior and posterior margins are about equally convex, so that the plates curve neither way. Apices usually bidentate, but plates 1 and 2 sometimes have only single points. Anterior margin of side-plate 4 usually serrate below. Postero-inferior angle of side-plates 5–7 quadrate with only very short points, though in the 2 ♀♀ of No. 5 they are somewhat stronger, but not nearly so strong as in Stebbing's specimens. None of the *pleon* segments are even faintly carinate, but pleon segment 3 is gibbous on posterior margin. The points in the middle of pleon segments 1 and 2 are not nearly so strong as in the typical specimens. *Telson* not so widely emarginate as in Stebbing's figure.

Antenna 1, 1st joint much stouter than, and $2\frac{1}{2}$ times as long as, 2nd and 3rd together, 2 tiny knobs at base on lower surface, lower apex produced in a long stout

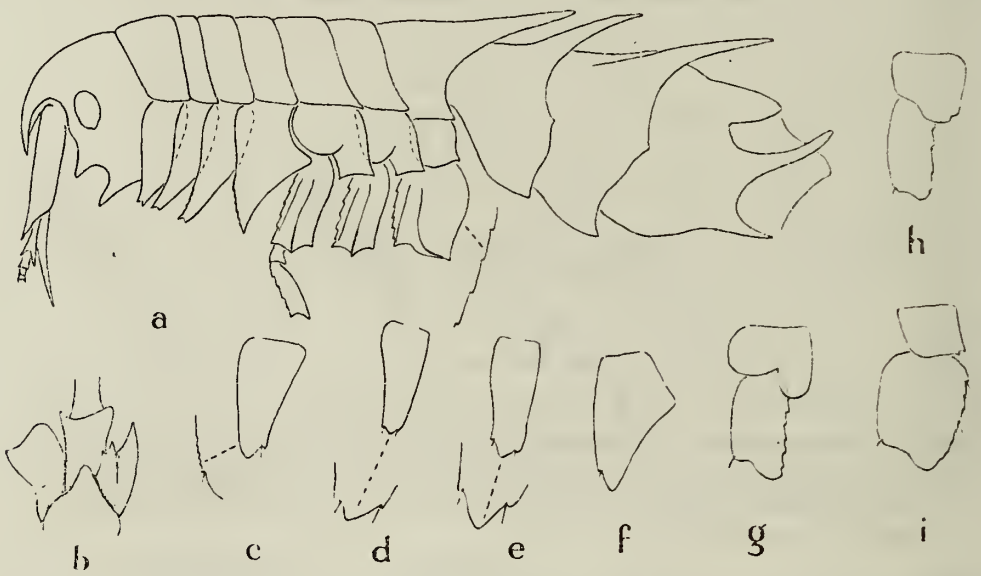

FIG. 27.—*Gnathiphimedia pacifica* (Stebb.). *a*, general view, posterior portion omitted; *b*, ventral view of right antenna 2; *c–i*, side-plates 1–7 with 2nd joint of peraeopods 3–5 of young from brood-pouch.

spine extending beyond 3rd joint, and its inner apex with a smaller spine (not bifid); 2nd joint twice as long as 3rd, its upper apex produced as a spine. Antenna 2 about as long as or a little longer than antenna 1, 1st joint small, forming a conical process ventrally, 2nd joint with a strong tooth on inner margin, a shorter one, apically bifid, on inner ventro-lateral margin, and a large thin laminate process on upper outer margin, the 1st and 2nd joints forming a kind of coronet around base of 3rd joint, 4th joint with a small denticle on upper distal apex, 5th joint a little shorter than 4th. *Epistome* wide and very short, often with a small gibbous median projection. Upper lip short, entire. *Mandible* as in *mandibularis* but apices not so broadly flattened to form grinding surfaces. *Maxilliped* with outer plate rather pointed, 2nd joint of palp not produced as in Stebbing's figure. Hind margins of 2nd joints of *peraeopods* 3–5 are only feebly serrulate.

The ♂ does not differ from the ♀, except in the narrower peraeon. The young taken from the brood-pouch of the largest ♀ in No. 6, and measuring 3·25 mm. in length, do not differ in any essential features from the adult. The side-plates are here figured for comparison. The large spine on 1st joint of antenna 1 only extends to end of 2nd joint.

Remarks.—Both Walker and Chevreux found that the spine on 1st joint of antenna 1 was much longer than in the specimens described by Stebbing. But in the present specimens there are other differences, which, while scarcely perhaps of specific value, are yet worth mentioning and figuring, and which are far more noticeable and important than the spine on antenna 1, as may be seen from the above description.

In fact, it is mainly deference to the opinions of these authors, and of Dr. Chilton, whose MSS. determination of some specimens from the "Nimrod" collection is before me, which restrains me from regarding these Antarctic specimens as specifically distinct from the "Challenger" specimens, a course which Schellenberg has adopted in describing a n. sp. (*sexdentata*). The present specimens appear to be the same as *sexdentata*, but whether they are really the same as Stebbing's *pacifica* I am still a little doubtful. A direct comparison between the "Challenger" and "Gauss" specimens is required.

Distribution.—Heard Island and Kerguelen, 231–273 metres; McMurdo Sound, 20–130 fathoms; Petermann Island and Marguerite Bay, 50–200 metres; "Gauss" winter station, 385 metres.

MAXILLIPHIMEDIA, n. g.

Diagnosis.—Epistome moderately short. Upper lip broad, asymmetrically incised. Mandible short, broad (antero-posteriorly) but thin, cutting-edge well developed, dentate, secondary plate small, no molar or spine-row. Lower lip without inner lobes, outer lobes not incised. Maxilla 1 with the 2-jointed palp enormously expanded into an ovate lamina. Maxilla 2 with both plates obovate. Maxilliped with outer plate very broad, 2nd joint of palp not produced along inner margin of 3rd. Antenna 1 with 1st joint stout but not much longer than 2nd. Side-plate 1 expanded below with inferior margin convex.

Maxilliphimedia longipes (Wlkr.). (Fig. 28.)

Walker, 1906, p. 151, and 1907, p. 29, pl. 9, fig. 17 (*Iphimedia*).

Occurrence.—Sta. 338, Antarctic; 1 ♂ 35 mm.

Description.—As described and figured by Walker with the following differences and additions. The large tooth at antero-inferior angle of lateral margin of *head* is acutely pointed. *Antenna* 1, 1st joint with slight knob at base on lower surface. Antenna 2 nearly as long as antenna 1, the 1st and 2nd joints as in *I. cyclogena*, but only the upper apex of 4th joint very shortly produced. *Epistome* wide, moderately short, with a strong gibbous knob proximally. Upper lip wide, asymmetrically incised, with

two transverse rounded ridges. Lobes of lower lip not incised. *Mandible* short, broad (antero-posteriorly) but thin, not laterally robust, cutting-edge well developed, dentate, with a stronger tooth at each end, secondary plate small, ovate, molar and spine-row obsolete, palp with 2nd joint longest, 1st shortest. *Maxilla* 1, inner plate small, ovate, with a few non-plumose setae on distal margin, outer plate obovate, with about 16 strong spines on distal margin, palp relatively enormous, 1st joint short, about as wide as long, 2nd joint expanded into a broad ovate lamina, with a few spinules along inner margin and apex. Maxilla 2, both plates somewhat obovate or clavate, apices with strong spine-setae. *Maxilliped*, inner plate with straight inner margin, strongly setose, outer plate broadly expanded, distally rounded, with a few minute setules on distal margin, 2nd joint of palp moderately expanded, but scarcely produced along inner

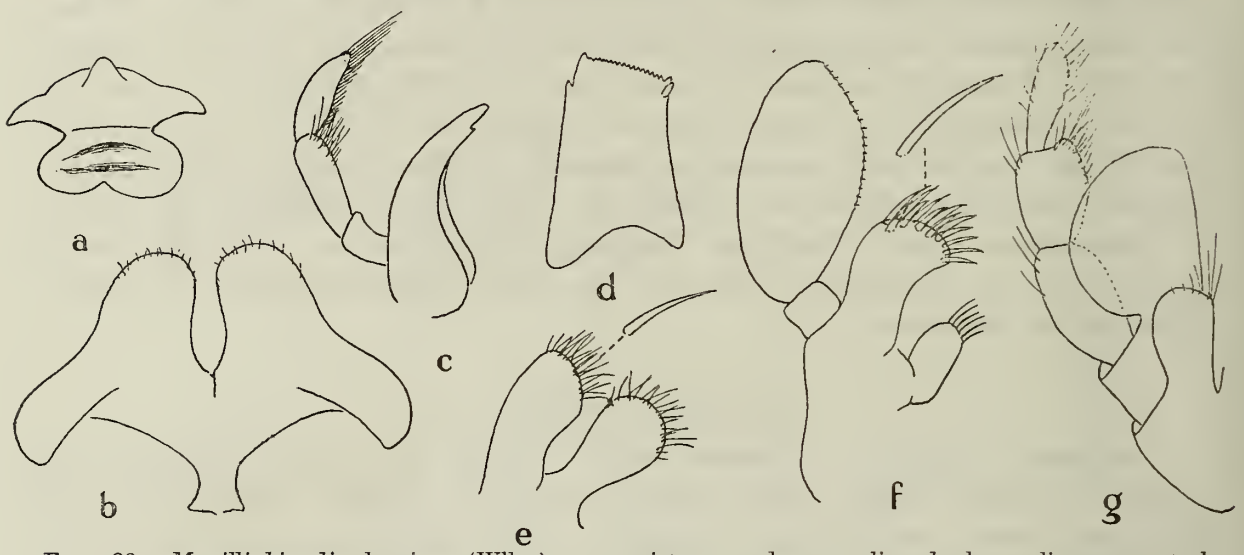

FIG. 28.—*Maxilliphimedia longipes* (Wlkr.). *a*, epistome and upper lip; *b*, lower lip; *c*, ventral view of right mandible; *d*, inner view of right mandible; *e*, maxilla 2; *f*, maxilla 1; *g*, maxilliped.

margin of 3rd joint. *Peraeopods* 3–5 increasing in length, as Walker says, but the 5th only reaching to end of telson when the pleon is fully extended.

Remarks.—This splendid specimen enables me to emend the generic position assigned to the species by Walker. The 1st side-plate and lateral margin of head are distinctive, and the only possible hesitation one can have in identifying this specimen with *longipes* is the fact that Walker, although he did not dissect his single specimen, did not mention the extraordinary maxillary palp which can be easily observed without any attempt at dissection.

The palp of the 1st maxilla, and to a lesser extent the outer plate of the maxilliped, remind one forcibly of a scooping apparatus, and possibly the former may function more in this manner than as a tactile organ. The dentate cutting-edge of the mandible probably indicates that the specimen has not long moulted (cf. *E. scotti*).

Distribution.—Coulman Island, 100 fathoms.

ANCHIPHIMEDIA, n. g.

Diagnosis.—Epistome moderately long. Upper lip asymmetrically incised. Mandible thin with rather wide cutting-edge, secondary cutting plate small, narrow, no molar, no spine-row. Lower lip without inner lobes, outer lobes not apically incised. Maxilla 1 with rudimentary palp, 2-jointed, 2nd joint smaller than 1st, tipped with 1 seta. Maxilla 2 with broad inner plate. Maxilliped with inner plate moderately broad, outer plate broad, 2nd joint of palp not produced along inner margin of 3rd. Antenna 1 with 1st joint not very stout and not much longer than 2nd joint.

Anchiphimedia dorsalis, n. sp. (Figs. 29, 30.)

Occurrence.—Sta. 355, Antarctic ; 1 ♂ 33 mm.

Description.—Lateral margin of *head* with two rounded lobes separated by a narrow notch. *Peraeon* segment 6 and pleon segments 1 and 2 each with 2 dorsal processes. Postero-inferior angles of all peraeon segments rounded or rounded-quadrate.

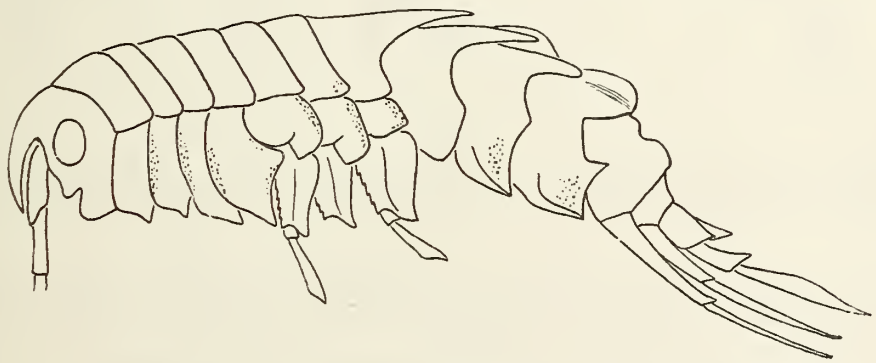

Fig. 29.—*Anchiphimedia dorsalis*, n. g., n. sp. general view ; the dots indicate reddish pigment spots.

Side-plate 1 oblong, not narrowed below, inferior margin concave ; 2 and 3 nearly similar, but inferior margin straight or nearly so, sloping downwards to the subacute postero-inferior angles ; side-plate 4 pointed below ; anterior margins of 1–4 entire ; 5 and 6 with antero-inferior angles of posterior lobes quadrate ; postero-inferior angles of 5–7 rounded-subquadrate. *Pleon* segments 2–4 with medio-dorsal carina, that on segment 4 divided into two by a rounded notch, the posterior portion longer than anterior. Pleon segment 3 without dorsal processes. Postero-inferior angles of segments 2 and 3 shortly pointed ; 3rd segment with a stronger point in middle of lateral margin. *Telson* oval, with raised rim all round, apically slightly incised.

Antenna 1, 1st joint stout but not extending beyond apex of rostrum, a small knob at base on lower margin, its apical margin forming a flange overlapping base of 2nd joint on dorsal, inner and outer sides ; 2nd joint about as long as 1st, 3rd two-thirds length of 2nd. Antenna 2 about as long as antenna 1, 1st joint small, forming a conical

process on lower outer side, 2nd joint with a dorsal tooth, an inner tooth, and a bifid ventral tooth, forming a coronet around base of 3rd joint, 4th and 5th joints subequal. *Mouth-parts* as figured. Epistome gibbous in front. No secondary plate in right mandible. Peraeopods 3 and 4, 2nd joint oblong, anterior half thick, separated from the thin posterior half by a raised longitudinal ridge, anterior margin straight, notched and spinulose, hind margin nearly straight, but slightly concave distally,

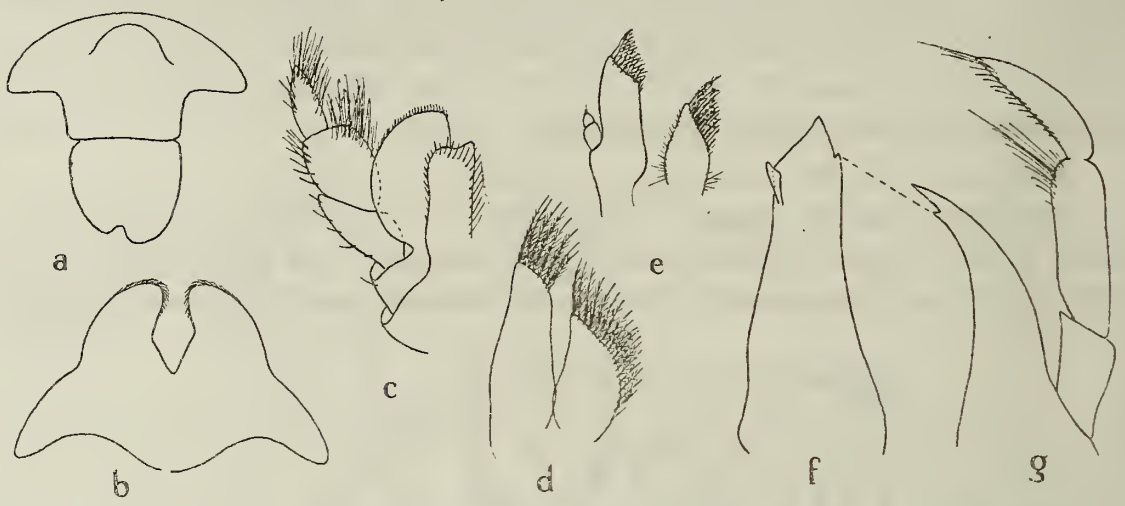

FIG. 30.—*Anchiphimedia dorsalis*, n. g., n. sp. *a*, epistome and upper lip; *b*, lower lip; *c*, maxilliped; *d*, maxilla 2; *e*, maxilla 1; *f*, inner view of left mandible; *g*, ventral view of left mandible.

postero-inferior angles rounded, 4th joint not strongly decurrent, anterior margins of 5th and 6th joints set with minute spinules in transverse rows. Peraeopod 5 similar but 2nd joint wider, especially at base, postero-inferior angle pointed.

ECHINIPHIMEDIA, n. g.

Diagnosis.—Eyes very prominent. Epistome moderately long, gibbous proximally. Upper lip entire. Mandible thin, cutting-edge entire (convex) secondary plate (if present) in right mandible only, no molar or spine-row. Maxilla 1 with palp as in *Iphimedia;* spines on outer plate very stout. Maxilliped with 2nd joint of palp not produced along inner margin of 3rd joint.

In addition to the above characters, the generic diagnosis might include: the spinose integumentary armature in contradistinction from the *paired* dorsal processes of other genera; the development of this armature is slight in *nodosa*, and culminates in *hodgsoni* and *scotti*. I consider that *pulchridentata*, Stebb., should also be referred to this genus; it is intermediate as regards the spiny armature between the extreme forms; on the other hand, it should be noted that Stebbing found a secondary plate in the left mandible as well as in the right, and the palpal joints of the maxilliped are rather slender.

Echiniphimedia hodgsoni (Wlkr.). (Fig. 31.)

Walker, 1906, p. 152, and 1907, p. 30, pl. 11, fig. 18 (*Iphimedia*).

Occurrence.—Antarctic: 1. Sta. 194, 1 ♀ 25 mm. 2. Sta. 314, 1 ♂ 26 mm. 3. Sta. 316, 1 ♂ 18 mm., 1 ♀ 20 mm. 4. Sta. 348, 1 ♀ 28 mm. 5. Sta. 355, 1 ovigerous ♀ 34 mm.

Description.—*Head* with a transverse groove at base of rostrum running down behind the eyes so that the latter appear very prominent; lateral margin with a rounded lobe separated by a narrow notch from the prominent antero-inferior spine; a supra-ocular spine is present in Nos. 2 and 3, or absent in Nos. 1, 4 and 5, but there are always 2 infra-ocular spines. *Peraeon* segments 1 and 7 and pleon segments 1–3 each with 2 zones of spines; peraeon segments 2–6 each with a single zone; pleon segment 4

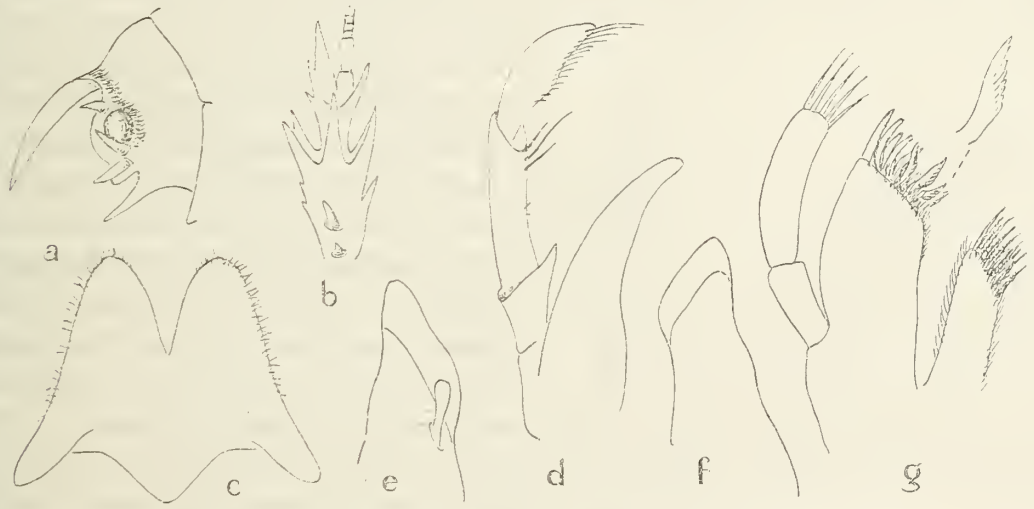

Fig. 31.—*Echiniphimedia hodgsoni* (Wlkr.). *a*, head; *b*, ventral view of left antenna 1; *c*, lower lip; *d*, ventral view of right mandible; *e*, inner view of right mandible; *f*, inner view of left mandible; *g*, maxilla 1.

with 3 zones; each zone is really double as the spines are arranged alternately; on the pleon the zoning becomes less regular. *Side-plates* similar to those of *I. margueritei*, postero-inferior angles of plates 5–7 rounded. *Telson* shallowly but broadly incised, apices acute.

Antenna 1 as here figured; in Nos. 1, 4 and 5 some of the spines are bifid or branched. Antenna 2 in general like those of *I. cyclogena* and *G. pacifica*, but the spines longer, and apices of 3rd-5th joints with spine-teeth. *Epistome* moderately long, with a short median spine proximally. Upper lip entire. *Mandible* thin, curved, cutting edge slightly convex, rounded at each end, secondary plate (if present) obovate, in right mandible only, no molar or spine-row, 1st joint of palp produced as a sharp point. *Maxilla* 1, outer plate with about 11 very stout spines, the inner ones cultrate and serrulate, inner plate with about 8 stout plumose spine-setae, apex of palp with

5 spine-setae. *Peraeopods* 3–5, the spines on the 2nd joints are submarginal, the actual margin being entire.

Remarks.—Walker mentions neither the groove behind the eyes nor the infra-orbital spines, features which are present in all the specimens here examined.

Echiniphimedia scotti, n. sp. (Fig. 32.)

Occurrence.—Sta. 316, Antarctic ; 1 (immature) ♀ 23 mm.

Description.—Head without spines. Lateral margin with 2 spinose points separated by a narrow notch. Post-ocular groove very feeble, but the eyes bulbous and prominent. *Peraeon* and pleon with strong stout recurved spines set in regular transverse rows: peraeon segments 1 and 7 and *pleon* segments 1, 2 and 4 each with two transverse rows, pleon segment 3 with 3 rows, peraeon segments 2–6 each with only a single row ; in the 1st row on peraeon segment 1 and the 2nd (posterior) row on segment 7 there are 6 spines, in the 2nd row on segment 1 there are 8, in the 1st row on segment 7 there are 5 ; in the rows on the other peraeon segments there are 8 main spines, with 1–2 smaller ones interpolated laterally ; on pleon segments 1–3 there are either 5 or 7 main spines in each row, with smaller extra ones infero-laterally ; in both rows on pleon segment 4 there are 3 spines. Thus on peraeon segments 1–6 there is no medio-dorsal spine in any row, but on peraeon segments 7 and pleon segments 1–4 there is a medio-dorsal spine in every row. *Side-plates* in general like those of *hodgsoni*, postero-inferior angles of 5–7 rounded. Side-plate 1 and 7 both with 1 spine, 2 and 3 both with 2 spines, 4 with 3, 5 and 6 with 5 spines ; in side-plate 4 the lower 2, and in plates 5 and 6 the lower 3 are set in a horizontal line and are very strong. *Telson* shortly and narrowly incised, apices blunt.

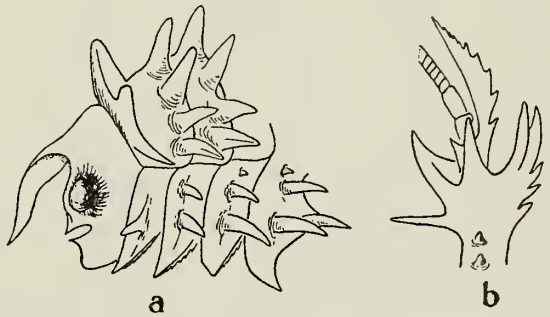

Fig. 32.—*Echiniphimedia scotti*, n. sp. *a*, head, peraeon segments 1 and 2, side-plates 1–4 ; *b*, right antenna 1 from below.

Antenna 1, 1st joint apically expanded into a broad horizontal lamina with strong acute points at distal angles, inner margin serrate, outer margin with one outstanding spine in right antenna (wanting in the left) ; lower margin with 2 short spines at base and one long one distally ; 2nd joint set in the cup formed by the apical spines on 1st joint, short, outer apex shortly produced, inner apex produced as a long thin spinous process, serrated on its inner edge, 3rd joint very small. Antenna 2 about as long as antenna 1, 1st and 2nd joints very similar to those of *G. pacifica* (as here figured), 3rd and 4th joints with upper apices very shortly produced. *Epistome* gibbous proximally, without a spine. Upper lip entire. *Mandible* as in *hodgsoni ;* the new mandible forming within the old has the cutting-edge dentate ; 1st joint of palp not sharply produced. A very thin and delicate secondary plate in the right mandible. Other

mouth-parts as in *hodgsoni*, the spines on outer plate of maxilla 1 not quite so strong. *Peraeopods* 3–5, 2nd joints with a submarginal row of 2–4 spines.

Remarks.—This form is clearly a second species of *Echiniphimedia* and confirms the validity of the genus. The very stout spines on the peraeon and pleon segments and the broad 1st joint of antenna 1 easily distinguish it from *hodgsoni* and *nodosa*.

Named in honour of the leader of the British Antarctic Expedition, 1910–1913.

Echiniphimedia nodosa (Dana). (Fig. 33.)

Bate, 1862, p. 125, pl. 23, fig. 1 (described and figured after Dana); Della Valle, 1893, Fauna u. Fl. Gulf, Naples, p. 583, pl. 58, figs. 89, 90. Stebbing, 1906, p. 216, and 1914, p. 358; Walker, 1906, p. 150, and 1907, p. 28, pl. 10, fig. 16 (*echinata*); Chevreux, 1913, p. 118.

Occurrence.—Antarctic: 1. Sta. 314, 1 ovigerous ♀ 33 mm. 2. Sta. 316, 2 ♀♀ 30 and 35 mm. 3. Sta. 318, 1 ♀ 38 mm. 4. Sta. 339, 1 ♂ 21 mm., 1 ♀ 27 mm. 5. Sta. 355, 1 ♀ 18 mm.

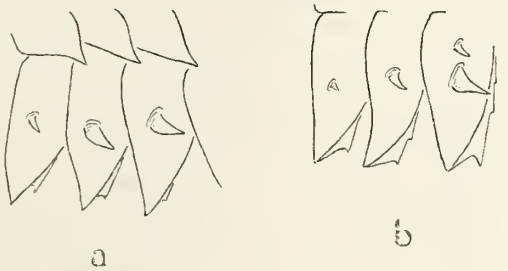

Fig. 33.—*Echiniphimedia nodosa* (Dana). Side-plates 1–3 (left side): *a*, from station 316; *b*, from station 339.

Remarks.—As Chevreux has identified both *nodosa* (Straits of Magellan) and *echinata* (south of Graham Land) in the collection of the Deuxième Expédition Antarctique Française, it becomes necessary to examine in detail the reasons for the above synonymy. Chevreux makes no comment on the differences. As a matter of fact a comparison of Dana's description and figure, as quoted by Bate, leaves no reasonable doubt that he and Walker described the same species. The real point is to try and link up Stebbing's description of Falkland Islands specimens (1906, p. 216) with Walker's *echinata*.

Walker (1907) refers to the variability of the number of teeth or denticles on the segments and side-plates, and the 7 specimens of the present collection fully endorse that statement.

Nos. 1 and 5. Peraeon segments 1–6 smooth, segment 7 with one (transverse) row of denticles on posterior margin. Pleon segments 1–3 have only 2–3 denticles subdorsally, in addition to the medio-dorsal carinal teeth and those on posterior margin. No carinal tooth on peraeon segment 7, only a denticle, carina on pleon segments 1 and 2 low, with an accessory tooth anteriorly. A single large horizontal tooth on both side-plates 5 and 6, that on 4 merely indicated by a small denticle. Side-plates 1–4 as figured by Walker, smooth, lower hind margins entire below the submarginal keel. Posterior margins of 2nd joint of peraeopods 3–5 with 1–2 tiny denticles (excluding the postero-inferior apical point).

No. 2. Peraeon segments 1–4 smooth, though in the smaller specimen there is a minute denticle on segment 4 on each side a little above the postero-inferior angle.

Peraeon segment 7 with 2 rows of denticles. Pleon segments 1–3 with 3–4 subdorsal denticles in the smaller, 7–10 in the larger specimen. Medio-dorsal (carinal) teeth on peraeon segment 7 and pleon segments 1 and 2 very strong, upstanding. Side-plates 4–6 each with 3 large teeth set horizontally, stronger in the smaller than in the larger specimen. Side-plates 1–4 in the larger specimen as figured by Walker, but with 2, 3, 4, and 5 denticles respectively in a transverse (vertical) row; the smaller specimen has only one strong tooth on each of plates 1–3, but in addition a small tooth on lower hind margin lying somewhat below the submarginal keel (fig. 33, *a*). Posterior margin of 2nd joint of peraeopods 3–5 with 2–3 teeth in the smaller, 5–7 in the larger specimen.

No. 3. Peraeon segments 1–5 smooth. Peraeon segment 7 with 2 transverse rows. Otherwise similar to the larger specimen of No. 2 but carinal teeth on pleon segments 1–3 less strong, fewer teeth on 2nd joint of peraeopods 3–5, and only one denticle on each of side-plates 1–3.

No. 4. Segments 1–5 (♂) or 1–4 (♀) smooth. Peraeon segment 7 with 1 row in ♂, 2 rows in ♀. Pleon segments 1–3 with 3–5 (6) subdorsal denticles. Medio-dorsal tooth on peraeon segment in ♂ small, carinal teeth on pleon segments 1–3 moderate; in ♀ carinal teeth on peraeon segment 7 and pleon segments 1–3 very strong, upstanding. Side-plates 4–6 each with a single tooth, "with serrated edge outwards" (Walker), feebly serrated in ♂, strongly in ♀. Side-plates 1–4 smooth in ♂, in ♀ 1 and 2 each with one denticle, 3 with a tooth and a denticle; lower apices of 1–3 in ♂ minutely serrulate, in ♀ as in the smaller specimen of No. 2, but with the teeth larger (fig. 33, *b*). Posterior margin of 2nd joint of peraeopods 3–5 with 2–3 denticles in ♂, 2 teeth in ♀.

Sufficient details are given above to show the variable nature of this form. The ♂ and the smallest ♀ (No. 5) bear the closest resemblance to Dana's figure. No. 1, an ovigerous ♀, is the least spinose, and the larger specimens (Nos. 3 and 4) tend to be the most spinose and to be characterised by the interpolation of a second transverse row of denticles on peraeon segment 7 anterior to the row on the posterior margin.

But neither Dana's description, nor Walker's, nor any of the present specimens agree with Stebbing's (1906) description, where it is stated that pleon segments 1–3 each have a *pair of very large dorsal teeth preceded by a large medio-dorsal triangular hump*. This description might apply to Dana's figure if the posterior tooth on pleon segments 1–3 in the profile figure was intended to represent one of a pair of subdorsal teeth and not a medio-dorsal tooth; but taken in conjunction with Dana's text I think these teeth were intended to represent medio-dorsal (carinal) teeth.

There is a further interesting point which is not mentioned by Dana or Walker, but is described by Stebbing and is found in all the present specimens: namely, the lateral carina just above the side-plates. In Stebbing's specimens it was present on peraeon segments 4–7; here it is present on all the peraeon segments. It is always prominent, though more so in the smaller No. 2 and the ♀ No. 4 than in the others. That it was actually present in Walker's specimens can scarcely be doubted. This lateral keel is thus the only link between the Falkland Island specimens and the

"Terra Nova" specimens; on the other hand, the former are strongly at variance with the latter in respect to the pleonal armature.

We have, therefore, two alternatives; either *echinata* is distinct from *nodosa*, or *nodosa* Stebb. is not the same as *nodosa* Dana. Geographical considerations, never very reliable, by which the *nodosa* localities were separated from the nearest *echinata* locality by Drake Strait, are considerably weakened by the finding of typical *echinata* at South Georgia by the "Discovery" (1925–1927) (the collection is now in my hands for report). The crucial point is the interpretation of Dana's figure; and as I have already stated, in my opinion Dana's text, taken in conjunction with his figure, leaves no doubt that *echinata* is synonymous.

Is, then, a new name required for Stebbing's specimens, or can one regard the Falkland Island specimens (and Chevreux's) merely as varieties of the true *nodosa* in the expectation that intermediate forms will be discovered? It is largely a matter of what value one attaches to Stebbing's words "very large" dorsal teeth. Are these pairs of teeth as large as in, e.g., *I. margueritei* or even *brevispinosa?* If so a new name is clearly indicated.

Some further comments on the present specimens may be given. The ocular lobe of *head* ends in a strong downwardly directed point, separated by a narrow notch from the somewhat quadrate antero-inferior angle. *Antenna* 1, 1st joint with 2 spines near base on lower surface, and 1 at apex in addition to the 2 on upper inner apex mentioned by Walker. *Epistome* rather short, with or without a median spine proximally. Upper lip entire, gibbous. Secondary cutting plate in right *mandible* only, obovate or cultrate. The spines on outer plate of *maxilla* 1 not extraordinarily strong. The palp of maxilla 1 has a linear 2nd joint, not ovate as figured by Della Valle. Walker says the *maxilliped* is like that of *pacifica* (except inner plate), but Stebbing figures the 2nd joint of palp of *pacifica* projecting along inner margin of 3rd joint, whereas here it does not. The horizontal arrangement of the spines on the *side-plates* 4–6 is comparable with that found in *scotti*, and the variation in the apices of side-plates 1–3 (figs. 33, *a* and *b*) show how the strongly bifid side-plates of *pulchridentata* may have evolved.

Distribution.—nodosa: Tierra del Fuego; Cape Virgins; Straits of Magellan. *echinata*: McMurdo Sound; South of Graham Land.

Family PARDALISCIDAE.

Stebbing, 1906, p. 220; Chevreux, 1911 (Bull. Inst. ocean. Monaco, No. 204, p. 7) (new genus); Schellenberg, 1926, p. 334.

Gen. SYNOPIOIDES, Stebb.

Stebbing, 1906, p. 226; Schellenberg, 1926, p. 336, and 1926 b, p. 224.

Synopioides macronyx, Stebb. (Fig. 34.)

Stebbing, 1888, pp. 1000, 1223, pl. 94 A; Schellenberg, 1926 b, p. 225, fig. 17.

Occurrence.—Sta. 130, New Zealand; 2 ♀♀ (1 ovigerous) 7 mm.

Description.—Rostrum acute, apically deflexed. *Eyes* invisible. Postero-lateral angle of *pleon* segment 3 quadrate. Pleon segments 3 and 4 without any processes; segment 5 with a very small dorso-lateral point on either side tipped with a spinule. *Telson* with the apical notch and setule on lobe very minute. *Antenna* 1 with 1st joint slightly swollen on upper apex. *Peraeopods* 1 and 2 with the 4th and 5th joints more strongly expanded than in Stebbing's figure. In other respects agreeing with Stebbing's description and figures.

Remarks.—The "Challenger" specimen had been mounted in glycerine during the voyage, and the small differences between its characters, as made out by Stebbing, and the present specimens may perhaps be ascribed to distortion under the cover-slip. The minute apical notches on the telson, however, would seem to constitute a real difference, but correspond with Schellenberg's description.

The rostrum is quite distinct from Stebbing's and Schellenberg's figures of *macronyx*, but agrees with Schellenberg's figure of *secunda* (1926 b, p. 224, fig. 16). Schellenberg (1926) at first referred the "Gauss" ♂♂ to *macronyx*, noting certain differences. In a footnote he states that after examination of further material from the "Valdivia" expedition they should be referred to *secunda*, Stebb., which in his opinion is not the ♂ of *macronyx* as suggested by Stebbing. In his account of the "Valdivia" specimens (1926 b) he figures the heads of both species, and enumerates the points of difference. In the main these lie in the shape of the rostrum and the length of the peduncle of uropod 1, both of which characters appear to be specific and not sexual, as ♀♀ of both forms were present in the "Valdiva" material (on one occasion taken together in the same haul).

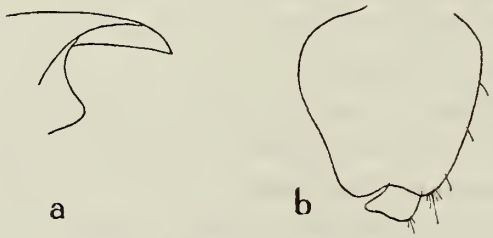

Fig. 34.—*Synopioides macronyx*, Stebb. *a*, rostrum; *b*, 2nd joint of peraeopod 5.

So few specimens of these forms have been captured that we cannot tell what amount of variation (if any) exists. Schellenberg had two young specimens of *macronyx*, and as he does not specially mention the shape of the rostrum, we must assume that even at that stage it resembles that of the adult. For the present I am quite satisfied with identifying these "Terra Nova" specimens with *macronyx*.

Distribution.—38° 7′ S., 94° 4′ W., 1500 fathoms; North and South Atlantic (43° N. and 31° S.) and Southern Indian Ocean.

Family LILJEBORGIIDAE.

Stebbing, 1906, p. 229.

Gen. LILJEBORGIA, Bate.

Stebbing, 1906, p. 230.

Liljeborgia aequabilis, Stebb.

Stebbing, 1888, p. 988, and 1906, p. 741 (merely mentioned), and 1910, p. 588.

Occurrence.—Sta. 134, New Zealand ; 1 ♀ 9 mm.

Remarks.—There are 3 minute denticles on the posterior margins of pleon segments 1 and 2, otherwise Stebbing's 1888 and 1910 descriptions apply. According to Stebbing (1910) the value of the dorsal denticles as specific characters has been discussed by Walker in Tr. Liverp. Biol. Soc., xxiii, p. 102, 1907, a paper I have not been able to consult.

Distribution.—South-East Australia.

Liljeborgia dubia (Hasw.). (Fig. 35.)

Thomson, 1902 (Ann. Mag. Nat. Hist. (7) x.), p. 463 (*haswelli*, habits) ; Stebbing, 1906, p. 233, and Gen. Cat. S.Afr. Crust. 1910, p. 454 ; Chilton, 1909, p. 619, 1912, p. 485, and 1921 a, p. 65.

Occurrence.—New Zealand : 1. Sta. 93, 1 ovigerous ♀ 9 mm. 2. Sta. 109, 1 ♂ 9 mm., 1 ♀ 7 mm. 3. Sta. 133, a lot ♂♂, ovigerous ♀♀ and juv. 5–10 mm. 4. Sta. 135, 13 ♂♂ 9–11 mm., 2 ovigerous ♀♀ 9 mm., 2 ♀♀ 8 mm., 13 juv. 5–7 mm. 5. Sta. 136, 2 ovigerous ♀♀ 7–8 mm., 5 juv. 4–6 mm.

Remarks.—Some specimens are tridentate on pleon segments 1 and 2, though

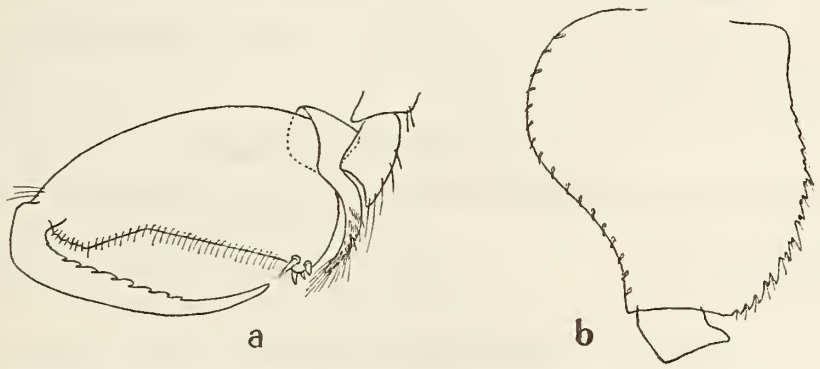

Fig. 35.—*Liljeborgia dubia* (Hasw.) ♂. *a*, gnathopod 2 ; *b*, peraeopod 5.

most are quinquedentate. Only the largest ♂♂ show the concave hand of gnathopod 2 and the enlarged 2nd joint of peraeopod 5 as here figured. There is often a second tooth, either strong or a mere denticle, on the hind margin of pleon segment 3 above the acutely produced postero-inferior angle.

Distribution.—South-East Australia, Tasmania, New Zealand ; McMurdo Sound ; South Africa.

Family OEDICEROTIDAE.

Stebbing, 1906, p. 235.

Gen. BATHYMEDON, G. O. Sars.

Stebbing, 1906, p. 255 ; Barnard, 1916, p. 163.

Bathymedon neozelanicus, n. sp.

Occurrence.—Sta. 135, New Zealand ; 2 ♂♂ and 1 ♀♀ (1 ovigerous) 4–5 mm.

Description.—*Rostrum* short, deflexed, acute. Two rather large irregular masses

of pigment on either side near top of head, which may represent the degenerate eyes, but no definite ocular elements. *Side-plates*, especially 1–4, with lower margins crenulate and setulose. Postero-inferior angle of pleon segment 3 rounded. *Telson* scarcely as long as broad, apically rounded, with 2 setae each arising from a little notch near the middle line.

Antenna 1, peduncle short, flagellum about 20-jointed, strongly setose. Antenna 2, 5th joint longer than 4th, upper margin of both with numerous short setules, flagellum elongate in ♂, only extending a little beyond antenna 1 in ♀. *Mouth-parts* as in *longimanus* (Sars, 1895, pl. 117). *Gnathopods* 1 and 2 very similar to those of *saussurei* (Sars, 1895, pl. 118, fig. 1) but more slender, especially gnathopod 2, 5th joint in gnathopod 2 scarcely at all widened distally, slightly longer than 6th joint, palm in both gnathopods so oblique that the hand can scarcely be described as subchelate. *Peraeopods* 1 and 2 also similar to those of *saussurei*, but 6th joint with anterior margin more strongly convex, the distal half with numerous long setae, so closely set as almost to form a brush. Peraeopods 3–5 similar to those of *saussurei*. *Uropods*, margins of rami minutely serrulate.

Remarks.—Apparently a southern representative of the northern *saussurei*, from which it differs in the gnathopods and telson. The smaller specimens have the antennae not quite so fully developed as the larger ones.

Gen. OEDICEROIDES, Stebb.

Stebbing 1906, p. 267 ; Chevreux, 1911, p. 403 ; Barnard, 1925, p. 348.

Oediceroides calmani, Wlkr.

Walker, 1907, p. 22, pl. 6, fig. 12 ; Chevreux, 1913, p. 128, figs. 28–30.

Occurrence.—Antarctic : 1. Sta. 338, 9 ♀♀ 17–28 mm. 2. Sta. 339, 3 ♂♂ 20–23 mm., 9 ♀♀ 20–26 mm. (some with ova or embryos) and several broken specimens.

Remarks.—Agree with Chevreux's specimens in having transverse grooves on all the peraeon segments.

Distribution.—Ross Sea and McMurdo Sound, 100 fathoms ; Marguerite Bay, south of Graham Land, 200–254 metres.

Oediceroides microcarpus, n. sp. (Fig. 36.)

Occurrence.—Sta. 136, New Zealand ; 8 specimens, including 1 ovigerous ♀ 3·5–5·5 mm.

Description.—*Back* smooth. *Eyes* distinct, contiguous on rostrum, which is strongly deflexed apically. *Telson* oblong, apex rounded, with 2 setae, each in a minute notch. *Mandible*, molar with triturating surface, 2nd joint of palp feebly curved. *Antenna* 1 shorter than antenna 2. *Gnathopods* 1 and 2 nearly alike, 5th joint very small, triangular, lower apex not projecting, 6th joint elongate-ovate, longer

in gnathopod 2 than in gnathopod 1, palm long, ill defined in gnathopod 1, not defined at all in gnathopod 2, slightly concave, setose. *Peraeopods* 1–5 without particular features. *Uropod* 3 not longer than uropods 1 and 2.

Fig. 36.—*Oediceroides microcarpus*, n. sp. *a*, *b*, gnathopods 1 and 2.

Remarks.—The distinctive character of this species is the very small 5th joint in gnathopods 1 and 2. Whether this feature is important enough to exclude the species from the genus *Oediceroides* is doubtful, especially as in other respects it fits better into this genus than into any other in the family.

Family SYNOPIIDAE.

Stebbing, 1906, p. 270.

Gen. SYNOPIA, Dana.

Chevreux, 1900, p. 64 ; Stebbing, 1906, p. 271.

Synopia ultramarina, Dana.

Stebbing, 1906, p. 271, and 272, figs. 68, 69 (*schéeleana*) ; Schellenberg, 1926, p. 341, fig. 49.

Occurrence.—Sta. 50, Atlantic, North ; 1 ♀ 2·75 mm.

Remarks.—Two single lateral lenses below the large eye. Flagellum of antenna 1 5-jointed, of antenna 2 13-jointed.

Distribution.—Tropical Atlantic and Pacific.

Family TIRONIDAE.

Stebbing, 1906, p. 273 ; Chevreux, 1913, p. 133 ; Barnard, 1925, p. 353.

Gen. SYRRHOITES, G. O. Sars.

Stebbing, 1906, p. 279 ; Barnard, 1925, p. 353.

Syrrhoites anaticauda, n. sp. (Fig. 37.)

Occurrence.—Sta. 351, Antarctic ; 1 ♀ 13 mm.

Description.—*Integument* (as preserved) thin, pellucid. Whole body from tip of rostrum to end of 6th pleon segment carinate. *Rostrum* strong, deflexed. Antero-lateral angles of head rounded. No trace of eyes. *Peraeon* segments 1 and 2, like the head and rostrum, feebly carinate. Segments 3–7 with the carina produced posteriorly into backwardly directed teeth, short and blunt on segments 3 and 4, but successively longer and more acutely pointed on the posterior segments, on segments 6 and 7 flanked on either side by a low rounded ridge. Postero-inferior angles quadrate, but with the actual angle rounded off, and on segments 5–7 with a submarginal projecting point

just above the angle; traces of similar points also on segments 3 and 4. *Side-plates* 1–4 of even depth, 1 widened below, hatchet-shaped, antero-inferior angle subacute, 4 acutely pointed below, biconcave behind. Side-plates 5 and 6 with posterior lobes quadrangular, the margin of the rounded anterior lobe continued across posterior lobe and projecting as a rounded tooth on side-plate 5, as an acute one on 6. Side-plate 7 ovate, with a submarginal acute point posteriorly.

Pleon segments 1 and 2 with the carina produced into teeth similar to those on the preceding peraeon segments; on segment 3 the carina forms a rounded projection ending posteriorly in an upturned acute hook (like the tail of a male mallard); on segment 4 the carina also forms a low rounded projection, and on segments 5 and 6 a sharply pointed tooth directed backwards. The dorsal teeth are flanked on either side by two low rounded ridges on each segment; laterally there is an acute tooth on segment 1, a subacute one on segment 2, and a rounded one on segment 3, con-

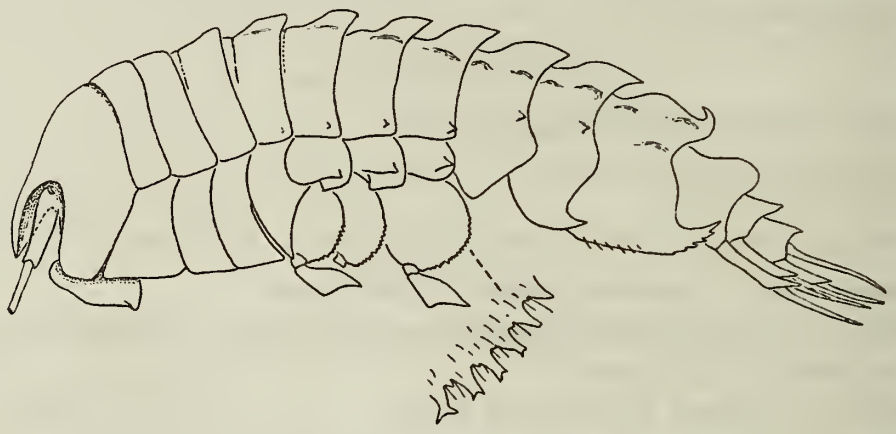

Fig. 37.—*Syrrhoites anaticauda*, n. sp. General view with portion of margin of 2nd joint of peraeopod 5 further enlarged.

tinuing the line of points on the lower margins of the posterior peraeon segments. Postero-inferior angle of segment 1 obliquely truncate, the antero-inferior angle rounded; of segments 2 and 3 produced backwards in a sharp tooth, stronger on segment 3 than on segment 2, and serrate on inferior margin; the hind margin above the points not serrate. *Telson* lanceolate, cleft not quite to middle, apices acute, but with a minute notch on inner margin bearing one seta.

Antenna 1, 1st joint extending to end of rostrum, basally enlarged on dorsal margin, 2nd joint shorter than 1st, rest lost. Antenna 2 extending back to about end of 2nd peraeon segment, 5th joint slightly shorter than 4th, both with small fascicles of setae along anterior margins, flagellum subequal to 4th peduncular joint, 10-jointed. *Epistome* prominent, carinate, nearly straight in profile. *Mouth-parts* as figured for *serrata* (Sars, 1895, pl. 137). Outer plate of maxilliped with 12 strong graduated acute spines on inner margin. *Gnathopods* 1 and 2, peraeopods 1 and 2 as in *serrata*. *Peraeopods* 3–5 as in *serrata*, but 2nd joint of peraeopod 5 more strongly expanded, hind margins complexly serrate, i.e. the large outstanding teeth are often separated

by 1–3 smaller teeth, and their apices are bifid ; setae arise between the teeth, and are also present submarginally. *Uropods* 1–3, peduncle with upper margin distally produced in a sharp tooth, especially strong in uropod 1, outer rami shorter than inner, especially in uropod 2.

Remarks.—This species differs from the other species of the genus in several characters, the most important being the dorsal carination, and the complex serrations on 2nd joints of peraeopods 3–5.

Family CALLIOPIIDAE.

Stebbing, 1906, pp. 285, 727.

Gen. LEPTAMPHOPUS, G. O. Sars.

Stebbing, 1906, p. 293.

Leptamphopus novaezealandiae (Thoms.).

Stebbing, 1906, p. 294 ; Chilton, 1920 (N.Z. Amphipoda, No. 1), p. 1, figs. 1–5 ; Schellenberg, 1926, p. 351 ; Stephensen, 1927, p. 315.

Occurrence.—1. Sta. 133, New Zealand ; 1 ovigerous ♀ 6 mm. (mutilated). 2. Sta. 194, Antarctic ; 1 ♂ 20 mm., 1 ♀ 19 mm. (both somewhat mutilated).

Distribution.—New Zealand and Auckland Islands ; Kerguelen ; "Gauss" winter station ; McMurdo Sound ; South Orkneys ; Petermann Island and Port Charcot.

Gen. APHERUSA, Wlkr.

Stebbing, 1906, p. 304 ; Chilton, 1921, p. 220.

Apherusa levis (Thoms.).

Chilton, 1921, p. 222, fig. 2.

Occurrence.—Sta. 135, New Zealand ; 1 ♀ with embryos 7 mm.

Remarks.—Postero-lateral angle of pleon segment 3 quadrate with a small point on one side (as in *translucens*) and a few setae on lower margin. The shape of the telson is very like that of *Paramoera australina*, var. *megalophthalma*, as figured by Stephensen (1927, p. 336, fig. 17), but not a bit like that of the same species as figured by Chilton (1921 a, p. 68, fig. 8) in his "Endeavour" report. Chilton does not discuss the position of *Apherusa laevis* (Hasw.) regarded by Stebbing (1906, p. 308) as doubtful.

Distribution.—New Zealand.

Gen. CHOSROES, Stebb.

Stebbing, 1906, p. 287.

Chosroes incisus, Stebb. (Fig. 38.)

Stebbing, 1888, p. 209, pls. 134, 135, and 1906, p. 287.

Occurrence.—Sta. 38, Atlantic, South ; 1 ♂ 10 mm.

Description of ♂.—Agreeing with the ♀ as described by Stebbing. *Telson* with the sides scarcely concave, the apical emargination more sharply defined, and in place of the group of subequal spines near the apex of each lobe there is here one very long spine flanked by one or two much smaller ones, and a small spinule nearer the apex.

Antenna 1 is preserved only on the one side; the calceoli appear to be far less numerous than in the type ♀. Both 2nd antennae are missing. *Gnathopod* 1, hand larger than in ♀, and distinctly larger than hand of gnathopod 2, palm slightly concave. *Peraeopod* 2, the middle of the lobe on front margin of 2nd joint has 3–4 feeble crenulations with a setule arising from each. Peraeopods 3–5, the angular incision on the hind margins of 2nd joints is more sharply defined.

Fig. 38.—*Chosroes incisus*, Stebb. ♂. *a*, telson; *b*, penis, with coil of filamentous spermatozoa.

Penial processes well developed. From the orifice of the vas deferens of each process there arises a very long coil resembling a loosely-wound fibrous rope. This is evidently an agglutinated mass of filiform spermatozoa, though it is impossible to trace the limits of any one spermatozoon. The coils were many times longer than shown in the figure, where only a portion is represented.

The specimen was not fully grown, as is shown by the new skin forming within the mouth-parts, etc.

Remarks.—This remarkable Amphipod, so very like a Podocerid at a cursory glance, does not seem to have been captured since the "Challenger" took a ♀ and a juvenile not very far from the locality where the "Terra Nova" took the ♂.

Distribution.—Off Cape Virgins, 55–70 fathoms.

REGALIA, n. g.

Rostrum well developed. Peraeon not dentate. Side-plates very shallow, 4th not excavate behind. Pleon segments 1 and 2 dorsally dentate. Mouth-parts as in *Calliopius*, but inner plate of maxilla 1 with only one seta. Gnathopods 1 and 2 alike, simple (scarcely subchelate), 5th joint subequal to 6th. Uropod 3 with very short peduncle. Telson short, scarcely as long as broad, apically truncate.

Remarks.—In spite of the well-developed rostrum, which makes the head bear a strong resemblance to that of *Neopleustes boeckii* (Sars, 1895, pl. 122, fig. 2), it appears impossible to place this new genus elsewhere than in the family *Calliopiidae*.

The name alludes to the locality, Three Kings Islands, where the specimens were caught.

Regalia fascicularis, n. sp. (Fig. 39.)

Occurrence.—Sta. 130, New Zealand ; 2 ♂♂, 5 ♀♀, and 7 immature 5–6 mm. (originally two lots, one preserved in alcohol, the other in formalin).

Description.—*Rostrum* prominent. Antero-lateral angle of head quadrate. Eye very large, subcircular. *Peraeon* segments not dentate. Side-plates very shallow, 4th not excavate behind, 5th bilobed. *Pleon* segments 1 and 2 each with a prominent medio-dorsal, backwardly directed tooth, flanked on either side by a dorso-lateral

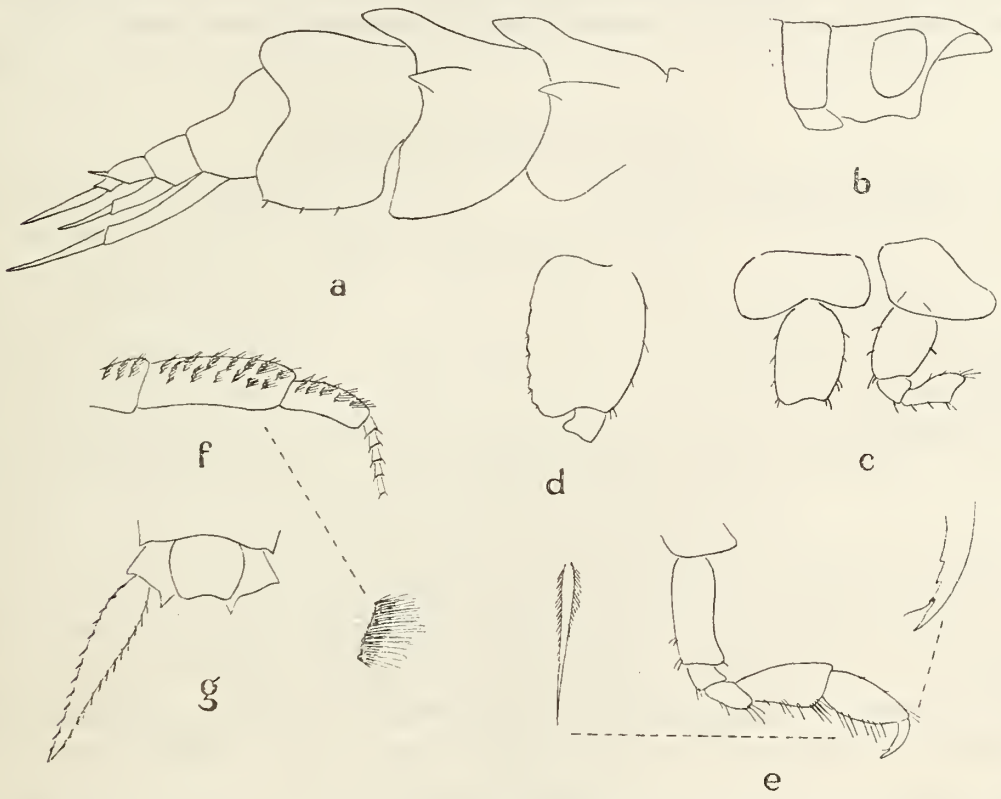

Fig. 39.—*Regalia fascicularis*, n. g., n. sp. *a*, lateral view of pleon ; *b*, head ; *c*, side-plates 3 and 4, with 2nd joint of peraeopods 2 and 3 ; *d*, 2nd joint of peraeopod 5 ; *e*, gnathopod 1 ; *f*, inner view of antenna 2 ; *g*, telson and uropod 3.

keel ending in a small tooth ; segment 3 gibbous, postero-inferior angle rounded or rounded-quadrate. *Telson* small, a little broader than long, apically truncate, lateral angles rounded.

Antenna 1, 1st joint stout ; rest lost in every specimen. Antenna 2 (present only in one ♂) extending back to about end of pleon segment 3, peduncle stout, 4th joint longer than 5th, 3rd, 4th and 5th joints with flattened fascicles of setae on dorsal edge and inner surface, the latter in the 4th joint alternating with the former, each fascicle consisting of very numerous short setae and less numerous longer setae, flagellum about 35-jointed, sparsely setose. *Mouth-parts* as in *Calliopius* (Sars, 1895, pl. 158), but inner plate of maxilla 1 with only one seta. *Gnathopods* 1 and 2 alike, 5th and 6th

joints subequal, palm oblique, not defined, lower margins of 5th and 6th joints with several serrulate or plumose spine-setae. *Peraeopods* 1 and 2, 2nd joint stout, but not expanded, other joints lost in all specimens. Peraeopods 3 and 4, 2nd joint moderately expanded. Peraeopod 5, 2nd joint ovate, hind margin feebly serrate. *Uropod* 1, rami subequal, shorter than peduncle, spinose and minutely serrulate. Uropod 2 present but mutilated or lost in all specimens. Uropod 3, peduncle very short, inner apex acutely produced, apparently biramous, but only one of the rami (the outer) preserved in all the specimens, extending beyond apex of uropod 2 (apparently) but not as far as apex of uropod 1, narrow-lanceolate, both margins spinose.

Family PARAMPHITHOIDAE.

Stebbing, 1906, p. 320 ; Chevreux, 1913, p. 148 (two new genera).

Gen. EPIMERIA, Costa.

Stebbing, 1906, p. 321 ; Barnard, 1916, p. 170.

Epimeria macrodonta, Wlkr.

Walker, 1906, p. 16, and 1907, p. 24, pl. 8, fig. 14 ; Chilton, 1912, p. 486 ; Chevreux, 1913, p. 148, and p. 149, figs. 41–43 (*similis*) ; Schellenberg, 1926, p. 342 (*similis* and *macrodonta*).

A. Forma *macrodonta*, Wlkr.

Occurrence.—Antarctic : 1. Sta. 194, 1 ♂ 20 mm. 2. Sta. 314, 1 ♂ 17 mm., 1 ♀ 19 mm. 3. Sta. 316, 1 ♀ 18 mm., and 16 ♀♀ 29–32 mm., some ovigerous. 4. Sta. 331, 1 ♀ 19 mm. 5. Sta. 338, 1 ♀ 33 mm. 6. Sta. 339, 3 ♀♀ 22, 23, 24 mm. 7. Sta. 348, 2 ♀♀ 25 mm. 8. Sta. 355, 2 ♀♀ 30 and 32 mm. 9. Sta. 356, 1 ovigerous ♀ 26 mm.

Remarks.—These specimens do not quite conform with Walker's description in certain respects.

Peraeon segment 1 is never quite twice as long as segment 2 (in Walker's figure it is scarce twice as long) ; but the 2nd segment is always appreciably shorter than the 1st and 3rd, and has the appearance of being squeezed in between these two segments.

Pleon segment 5 has no single medio-dorsal tooth as described by Walker ; on the contrary, it resembles the 6th segment in having a dorso-lateral upstanding tooth or spine on each side (cf. Chilton, 1912).

The 7th side-plate always has the postero-inferior angle at least quadrate, often with a small projecting point.

The 2nd joint of antenna 1 is always distinctly shorter than 1st joint, provided that the distal spinose projections are not reckoned (which is the logical method of measuring a joint).

The anterior margin of 2nd joint of peraeopod 3 is not always concave as shown in Walker's figure.

The four latter characters are among those listed by Chevreux as distinguishing *macrodonta* from *similis*. The present specimens show that these characters are not distinctive.

Again, other characters, such as the length of the rostrum, relative lengths of joints in gnathopods 1 and 2, peraeopods 1 and 2, and the peduncle and rami of the uropods, are not constant. In some specimens, *e.g.*, the rami of uropod 3 are scarcely more than twice the full (ventral) length of the peduncle.

Thus some of the distinctions between *macrodonta* and *similis* are seen to break down, and I cannot regard the latter as other than a form of *macrodonta*. Further bridging of the alleged differences between the two species is indicated below.

B. Forma *similis*, Chevr.

Occurrence.—Antarctic: 1. Sta. 314, 1 ♂ 19 mm., 3 ♀♀ 17–18 mm. 2. Sta. 316, 1 ovigerous ♀ 41 mm. 3. Sta. 338, 3 ♀♀ 25, 28, 32 mm., 3 ovigerous ♀♀ 25, 25, 30 mm. 4. Sta. 348, 1 ♀ 32 mm.

Remarks.—These specimens are at once referable to the form *similis* by the broader and shorter dorsal processes. In *macrodonta* these processes taper nearly regularly from base to apex, whereas in *similis* they are of the same width for an appreciable distance before the dorsal profile takes a distinct bend, and the process then tapers rapidly to the apex. In the present collection there is only one specimen (No. 5, *macrodonta*) which might possibly be considered as intermediate.

The 2nd peraeon segment is certainly a little longer than in typical *macrodonta*, but never quite equal to the 1st segment as in Chevreux's specimens.

Side-plates 1–3 appear different in the figures of Walker and Chevreux, but I think that is mainly because Chevreux shows them separated almost to the base, whereas Walker figures them in their normal overlapping position. There is no conspicuous difference in the present specimens between the side-plates of the two forms, though the width of side-plate 2 is naturally dependent on that of its segment.

Side-plate 7 quadrate, or with a small point, as in *macrodonta* above.

Pleon segment 5 with the same 2 dorso-lateral spines as in *macrodonta*, or (as in No. 2) smooth.

Anterior margin of 2nd joint of peraeopod 3 slightly concave in some specimens.

Spines on 1st and especially on 2nd joint of antenna 1 not so long as in *macrodonta*, but otherwise there is no essential difference.

Thus the only real difference between the two forms is the shape of the dorsal processes, and to a lesser extent the relative lengths of the first two peraeon segments.

Therefore one seems fully justified in regarding *similis* as a varietal form of *macrodonta*, both occurring together in the McMurdo Sound area, and apparently at the "Gauss" winter station.

The ovigerous ♀ from Sta. 316 is the largest specimen of either form yet recorded.

Distribution.—macrodonta: McMurdo Sound, 500 fathoms; Coats Land, 161 fathoms; near Graham Land, 60–200 metres; "Gauss" winter station 385 metres. *similis:* South Shetland Islands, 420 metres; "Gauss" winter station, 385 metres.

Epimeria inermis, Wlkr. (Fig. 40, *b*.)

Walker, 1903, p. 54, pl. 10, fig. 69; non Walker, 1907, p. 23.

Occurrence.—1. Sta. 38, Atlantic, South; 1 ♀ with embryos 19 mm. 2. Sta. 338, Antarctic; 4 ♀♀ 18, 28, 29, 30 mm. 3. Sta. 339, Antarctic; 1 ♀ 20 mm.

Description.—Integument indurated, shagreened with fine close-set punctures, which become larger and more noticeable on pleon segments 1–4. *Rostrum* strong, broad, as long as rest of head. *Peraeon* and pleon as described by Walker; the tubercles on the lower parts of the peraeon segments mentioned by Walker are not developed in these specimens. The posterior margin of *pleon* segments 3 and 4 is dorsally raised into a low transverse ridge; the 4th pleon segment (Walker: 1st

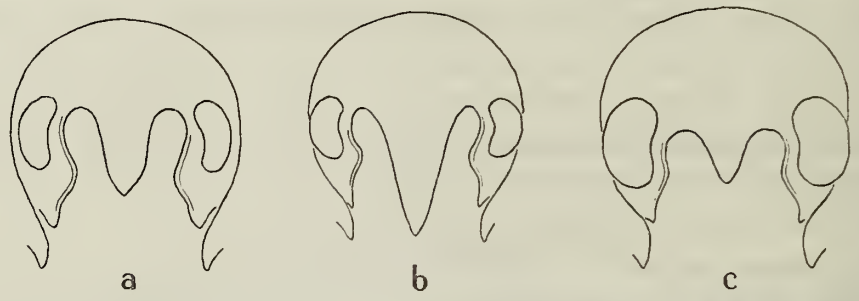

Fig. 40.—Frontal view of head of: *a*, *Epimeria robusta*, n. sp.; *b*, *E. inermis*, Wlkr.; *c*, *Epimeriella walkeri*, n. sp.

urosome segment) has a distinct medio-dorsal keel which is concave in the middle, as shown in Walker's figure. Side-plate 4 is more angular below than in Walker's figure which shows it in perspective, not as a true profile.

Antenna 1, 1st joint stout, 2nd and 3rd successively shorter, flagellum a little longer than peduncle, a minute scale-like, 1-jointed accessory flagellum. Antenna 2 longer than antenna 1, 2nd joint with 3 teeth on inner apical margin, 4th joint longest. *Mouth-parts* as figured for *cornigera* by Sars (1895, pl. 128), even to the scarious inner margin of outer plate of maxilliped. Upper lip apically incised. *Gnathopods* 1 and 2, peraeopods 1 and 2 as in *cornigera*, but not quite so strongly setose. *Peraeopods* 3–5, 2nd joint deeply channelled behind (or with a longitudinal keel; whichever method of description is preferred); hind margins in peraeopods 3 and 4 with a blunt tooth proximally, and a rounded apex distally; in peraeopod 5 expanded proximally, distally abruptly narrowing to the rounded apex (in all three peraeopods closely resembling *tuberculata*, cf. Sars, pl. 129, fig. 2). Walker's figure does not show the tooth at base of peraeopod 4, and exaggerates the length of the broadened portion in peraeopod 5. The hind apices of the 4th joints also are more decurrent than in Walker's figure.

Peraeopod 5 is subequal in length to peraeopods 3 and 4. *Uropod* 2, outer ramus scarcely more than half length of inner ramus.

Remarks.—The strong rostrum and the carinate peraeon distinguish this species from the following two species.

The locality west of the Falkland Islands (Sta. 38) constitutes a notable extension of the distribution. Neither of the two French Antarctic Expeditions took this species in the Graham Land—Cape Horn area.

Distribution.—Cape Adare, 28 fathoms.

Epimeria robusta, n. sp. (Figs. 40, *a*, and 41.)

Walker, 1907, p. 23, pl. 8, fig. 13 (*inermis*, non Walker, 1903).

Occurrence.—Antarctic: 1. Sta. 220, 1 ♀ 34 mm. 2. Sta. 314, 1 ♂ 22 mm. 3. Sta. 316, 4 ♀♀ 20, 27, 28, 40 mm. 4. Sta. 331, 2 ♂♂ 24 mm., 1 ♀ 19 mm. 5. Sta. 338, 1 ♂ 26 mm., 6 ♀♀ 24, 26, 28, 35, 38, 42 mm. (the largest ovigerous). Types.

Fig. 41.—*Epimeria robusta*, n. sp., general view; the punctuation is indicated on the 1st peraeon and 3rd pleon segments.

6. Sta. 348, 2 ♀♀ 37, 38 mm. 7. Sta. 349, 2 ♀♀ 40, 41 mm. 8. Sta. 355, 4 ♂♂ 20–23 mm., 5 ♀♀ 21–40 mm. 9. Sta. 356, 1 ♂ 16 mm., 2 ♀♀ 33, 38 mm. (the larger ovigerous).

Description.—Body robust. Integument indurated, with scattered obscure punctures, rather more noticeable on the pleon segments. *Rostrum* scarcely as long as rest of head. *Peraeon* smooth and broadly rounded, without any suggestion of carination except sometimes very faintly on peraeon segment 7. Postero-inferior angles of segments 1–4 rounded, of segments 5–7 slightly produced. *Pleon* segments 1 and 2 with faint indication of a dorsal keel; segment 3 with a low keel which rises to a small upstanding point on hind margin; segment 4 gibbous at base, then with a transverse depression, then rising into an upstanding triangular point on hind margin; segment 5 smooth, very short; segment 6 with a low medio-dorsal keel ending in a small knob over base of telson, and a dorso-lateral keel on each side ending in a short

tooth. *Side-plates* 1–3 tapering below, 4 as in *inermis*, 5 more lozenge-shaped and without the tubercular swelling found in *inermis*, 6 quadrangular, deeper than long, with an oblique ridge from the quadrate postero-inferior angle, 7 relatively small, rounded below. *Pleura* of pleon segments 1–3 as in *inermis*.

Antennae 1 and 2, and mouth-parts as in *inermis*. *Gnathopods* 1 and 2, 5th and 6th joints rather more expanded distally than in *inermis* (cf. *loricata*, Sars, pl. 129, fig. 3). *Peraeopods* 1 and 2 as in *inermis*. Peraeopods 3–5 as described and figured by Walker, the hind margin of the tooth on peraeopod 3 not always crenulate or that of peraeopod 5 setulose. Peraeopod 5 subequal in length to peraeopods 3 and 4. *Telson* and uropods as figured by Walker. Outer ramus of uropod 2 about half length of inner ramus.

Remarks.—Even if there had not been specimens of the true *inermis* in the present collection, it was obvious that the "Discovery" (1901–1904) specimens attributed by Walker to his *inermis* could not be that species unless his figure 69 (1903) was quite inaccurate as regards the 2nd joint of peraeopods 4 and 5. The present species is distinguished at once by the broad smooth peraeon and the 2nd joints of peraeopods 3–5, as well as by other less important characters.

Parasites.—In the largest ♀ of No. 3 (40 mm.) and one of the largest ♀ of No. 8 (39 mm.), the brood-pouch was fully formed as if it contained ova or embryos, but instead was occupied by an Epicaridean parasite. In No. 3 the parasite was so broken and damaged as to be useless for study; but in No. 8 there were two of the parasites, in shape ovoid or subspherical, and measuring 5 and 8 mm. in longest diameter. Both these "balls" were filled with loose granular matter, but externally exhibited no morphological features whatsoever. They are certainly not typical members of the genus *Podascon*, but probably should be included in the *Podasconidae*. Larvae in the Cryptoniscan stage were found in both the ♀♀ mentioned.

Distribution.—McMurdo Sound.

Epimeria puncticulata, n. sp. (Fig. 42.)

Occurrence.—Antarctic: 1. Sta. 318, 1 ♀ with embryos 17 mm. 2. Sta. 356, 1 ovigerous ♀ 16 mm. Type.

Description.—*Integument* indurated, with numerous close-set punctures, which become quite conspicuous, almost pits, on the pleon segments. *Rostrum* nearly as in *robusta*, slightly shorter than rest of head. *Peraeon* smooth, broadly rounded without any suggestion of carination. Postero-inferior angles of peraeon segments 1–4 rounded, of segments 5–7 somewhat produced. *Pleon* segment 1 with feeble indication of a keel, segments 2 and 3 distinctly keeled, segment 4 gibbous at base, then with transverse depression, then raised into a triangular tooth, segment 5 very short, smooth, segment 6 with faint medio-dorsal and dorso-lateral keels, the latter ending in very small points. *Side-plates* 1–3 tapering below, 4 deeper than long, the concave lower hind margin thick, flattened, continuous with the similar lower margin of side-plate 5 which is slightly

longer than deep, side-plate 6 oval, rounded below, 7 smaller, also rounded below. *Pleura* of pleon segments 1–3 increasing in acuteness at postero-inferior angles, that of segment 3 ending in an upturned hook, no angular projections in centre of lateral margins. *Telson* tapering, apically acute.

Antenna 1 and 2, and mouth-parts as in *robusta* and *inermis*. *Gnathopods* 1 and 2, 5th and 6th joints rather slender, as in *parasitica* (Sars, pl. 129, fig. 1). *Peraeopods* 1 and 2 as in *inermis* and *robusta*. Peraeopods 3 and 4, 2nd joints with blunt triangular process at base of hind margin, apex produced into a point, especially strong on peraeopod 3. Peraeopod 5, 2nd joint ovate, hind margin with a feeble indent near distal end which is produced in a rounded lobe extending beyond end of 3rd joint. *Uropod* 2, outer ramus $\frac{2}{3}$ length of inner ramus.

Remarks.—This species has a thick solid 5th side-plate, almost as strongly developed

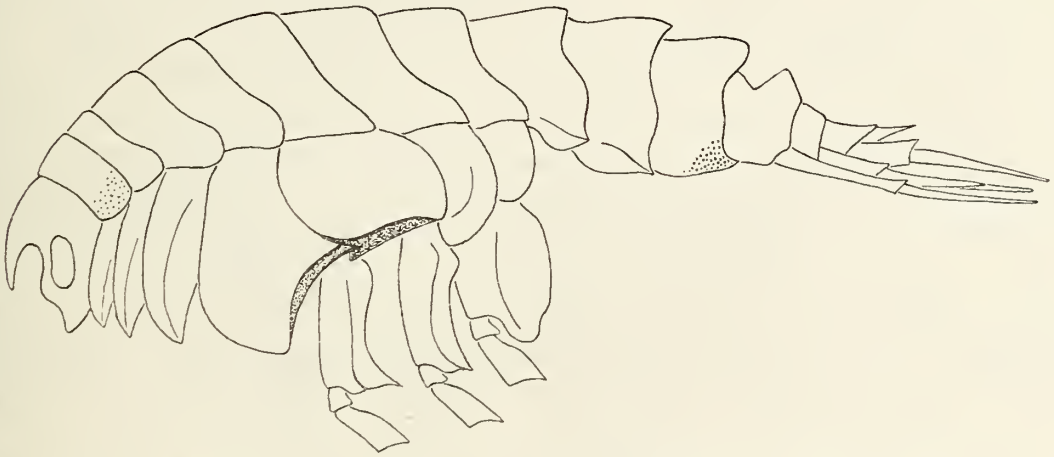

Fig. 42.—*Epimeria puncticulata*, n. sp., general view; the punctuation is indicated on the 1st peraeon and 3rd pleon segments; the lower margins of the 4th and 5th side-plates are shown a little more clearly than would be the case in a true profile.

as in *inermis*. The 4th side-plate also on its lower hind edge is solid, more solid than in *inermis*. Differential characters, however, between this species and both *inermis* and *robusta* are well marked, viz. the 4th side-plate, and 2nd joints of peraeopods 3–5. The puncturation of the peraeon and especially of the pleon is rather stronger than in *inermis* and *robusta*, hence the specific name.

Gen. EPIMERIELLA, Wlkr.

Walker, 1906, p. 17, and 1907, p. 26.

Body smooth, with or without dorsal processes on pleon segments 1–3, segment 4 keeled. Rostrum short or very short. Side-plates in general as in *Epimeria*, the 4th fitting into a groove in 5th. Mandible with a thin setose lamina in place of the normal tubercle with grinding surface. Peraeopod 5 much shorter than peraeopods 3 and 4 (in adult). Eyes large.

Remarks.—Walker's diagnosis is herewith slightly altered to include the new species described below; if further species come to light it may want altering again. At present the essential features are the modification of the molar tubercle in the mandible, and the short 5th peraeopod.

Epimeriella macronyx, Wlkr.

Walker, 1906, p. 17, and 1907, p. 26, pl. 9, fig. 15; Schellenberg, 1926, p. 344.

Occurrence.—Antarctic: 1. Sta. 326, 1 ♀ 21 mm. 2. Sta. 326, 4 juv. 6 mm. 3. Sta. 342, 1 juv. 6 mm.

Description (large ♀).—*Integument* soft (as preserved), with close-set minute pits or corrugations producing a more or less transverse scabrous appearance, especially on pleon segments. *Head* with antero-lateral angle angular. Rostrum a mere point. Eyes large, red-brown. *Peraeon* smooth, rounded, without any carination. *Pleon* segments 1–3 with low medio-dorsal indication of a keel, which, however, only becomes really keel-like on segment 3 where it ends in a short quadrate tooth; segment 4 gibbous at base, then transversely depressed, then raised into a backwardly pointing tooth; segment 6 with faint medio-dorsal and dorso-lateral keels, the latter with small points posteriorly. Postero-inferior angles of segments 1–3 with minute points. *Gnathopods* 1 and 2 as figured by Walker, 2nd joints setose, 5th and 6th subequal, 6th ovate, palm oblique, not defined from the lower margin except by the fine and regular pectination. *Peraeopods* 3 and 4, dactylus subequal to 5th joint and $\frac{2}{3}$ length of 6th. Peraeopod 5, 2nd joint with postero-inferior lobe rounded. *Uropod* 2, outer ramus about half length of inner ramus.

Remarks.—The description of the large ♀ is given above for comparison with *scabrosa*. The elongate dactyli of peraeopods 3 and 4 characterise both the adult and the young, though in the latter they are, as Walker stated, relatively longer.

Distribution.—McMurdo Sound, 5–10 fathoms; "Gauss" winter station, 385 metres.

Epimeriella scabrosa, n. sp. (Fig. 43.)

Occurrence.—Sta. 194, Antarctic, 1 ovigerous ♀ 14 mm.

Description.—Closely resembling *macronyx* in general, but smaller. *Body* not very robust. Integument not indurated (as preserved, but perhaps softened by the formalin in which the specimen was preserved), with close-set minute pits, foveolae or corrugations producing especially on the pleon segments a more or less transverse scabrous appearance. The sculpturing is present also on the 2nd joints of peraeopods 3–5. *Rostrum* a mere point. Eye large, red-brown. Antero-lateral angle of head rounded. *Peraeon* smooth, rounded, without any carination, though there is a very small median point on segment 7; postero-inferior angles of segments 1–4 rounded,

of 5–7 quadrate. *Pleon* segments 1–3 with dorsal keels produced backwards into pointed teeth, segment 4 gibbous at base, then with a transverse depression, then raised into a rounded keel, segment 5 very short, segment 6 with faint medio-dorsal and dorso-lateral keels, the latter with small points posteriorly. *Side-plate* 1 rounded below, 2 also rounded but more narrowly, 3 pointed, 4 a little deeper than long, not produced forwards, 5 rounded, its front margin overlapping side-plate 4 more than usual, i.e. the groove into which side-plate 4 fits is not so near the anterior edge of 5 ; 6 rounded-quadrate, 7 ovate. Postero-inferior angles of pleon segments 1 and 2 with very small points, of 3 quadrate. *Telson* tapering, apically incised.

Antenna 1, peduncle short, 1st joint scarcely longer than broad, 2nd and 3rd shorter

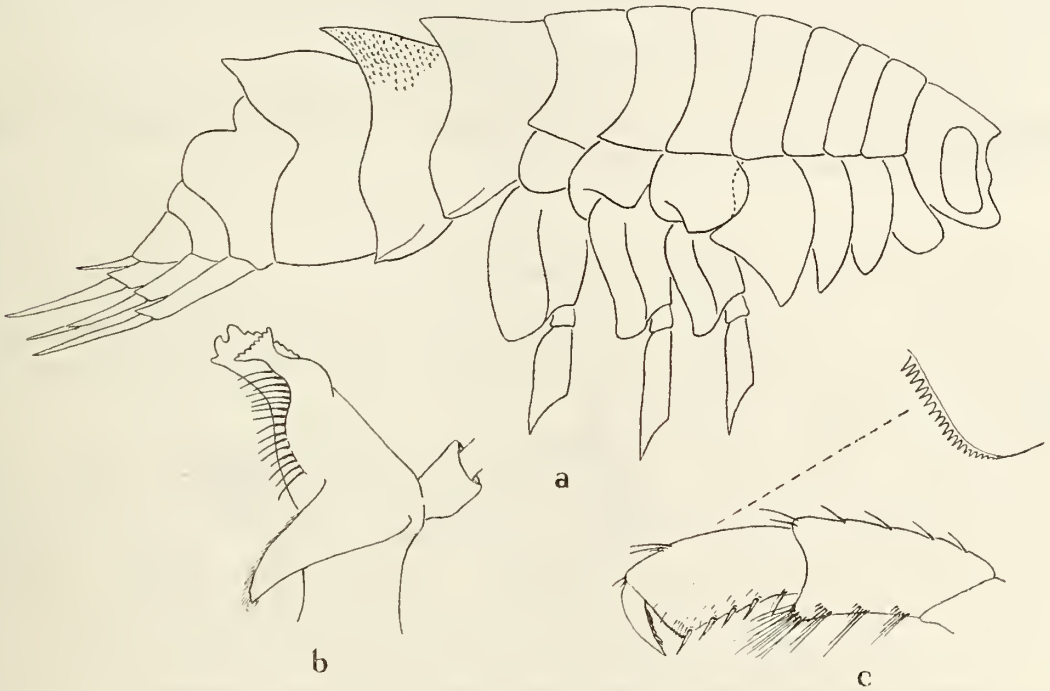

Fig. 43.—*Epimeriella scabrosa*, n. sp. *a*, general view, the scabrous punctuation is indicated on the 2nd pleon segment ; *b*, mandible ; *c*, gnathopod 1, with palm further enlarged.

than broad, flagellum elongate (at least 8 mm. in length). Antenna 2 broken off. *Upper lip* apically incised. *Mandible* with molar reduced to a short laminate process, setose along its margin, and completely without grinding surface ; otherwise normal. Other mouth-parts normal. *Gnathopods* 1 and 2 robust, 2nd joint strongly setose, 5th and 6th oblong, in gnathopod 1 stout, in gnathopod 2 rather more slender, 6th joint narrower and shorter than 5th, palm well developed, nearly transverse, with fine and regular pectination, dactylus with several stout spines on its lower margin. *Peraeopods* 1 and 2, 2nd joints strongly setose, dactylus half length of 6th joint. Peraeopods 3 and 4, 2nd joint oblong, hind margin nearly straight, obscurely serrulate, lower hind angle quadrate, dactylus scarcely half length of 6th joint. Peraeopod 5, 2nd joint ovate-oblong, hind margin gently convex, obscurely serrulate, lower hind angle quadrate,

4th conspicuously broader than in peraeopods 3 and 4; distal joints broken. *Uropod* 2, outer ramus about $\frac{2}{3}$ length of inner ramus.

Remarks.—In spite of the smaller size, dorsal teeth on pleon segments 1–3, gnathopods 1 and 2, and the normal-sized dactyls of peraeopods 3 and 4, I was reluctant to consider this an undescribed species until an actual full-grown specimen of the true *macronyx* was discovered in the collection, which allowed a direct comparison of the two forms and showed that they were distinct.

As a matter of fact, the size of the dactyli might be taken as conclusive, because it is highly improbable that young specimens with such enormously elongated dactyls as seen in *macronyx* should become perfectly normal in this respect when grown up. The dactyls do certainly become a little shorter in the adult, but nevertheless the adult fully deserves the specific name bestowed by Walker.

The differential characters of *scabrosa* have just been pointed out. The gnathopods, though differing from those of *macronyx* in the shape and size of the 5th and 6th joints, bear the same pectination on the palm.

Epimeriella walkeri, n. sp. (Figs. 40, *c*, and 44.)

Occurrence.—Antarctic: 1. Sta. 338, 6 ♀♀ 23–29 mm. (the largest ovigerous, the others with embryos). Types. 2. Sta. 339, 3 ♀♀ 19, 24, 27 mm. (the largest with embryos). 3. Sta. 348, 1 ♀ 23 mm.

Description.—Body robust. Integument indurated, shagreened with minute close-set punctures, which become more conspicuous on the pleon. *Rostrum* short, reaching to middle of 1st joint of antenna 1. Eye large. *Peraeon* smooth and broadly rounded, without any suggestion of carination. Postero-inferior angles of segments 1–4 rounded, of 5–7 slightly produced. *Pleon* segments 1–3 with mere suggestions of dorsal keels, segment 4 gibbous at base, then with a transverse depression, then raised into a rounded or subtriangular tooth, segment 5 very short, smooth, 6 with faint medio-dorsal and dorso-lateral keels, the latter rounded (not toothed) posteriorly. *Side-plate* 1 not tapering but truncate below, anterior margin sinuous, 2 and 3 tapering below to subacute apices, 4 about as long as deep, conspicuously produced forwards in a rounded lobe, 5 ovate, 6 oblong, rounded below, 7 small, also rounded below. Postero-inferior angle of pleon segment 1 rounded, of 2 and 3 with short sharp points. *Telson* tapering, apically incised.

Antenna 1, peduncle short. *Mouth-parts* as in *scabrosa*. *Gnathopods* 1 and 2 robust, 5th and 6th joints stout, 6th without palm, the lower margin sloping towards base of dactylus with only a very small apical lobe formed by a thin scarious margin which is composed of fused spinules (cf. the inner margin of the outer plate of maxilliped), dactylus with several stout spines on its lower margin. *Peraeopods* 1 and 2, dactylus at most half length of 6th joint. Peraeopods 3 and 4, 2nd joint oblong, hind margin in peraeopod 3 straight, slightly produced at lower apex, in peraeopod 4

lower apex square, dactylus normal, about $\frac{1}{3}$ length of 6th joint. Peraeopod 5 conspicuously shorter than peraeopods 3 and 4, 2nd joint ovately expanded, lower hind apex produced downwards in a lobe extending beyond apex of 3rd joint, 4th joint shorter and much wider than 4th joint in peraeopods 3 and 4, dactylus normal, about $\frac{1}{3}$ length of 6th joint, total length of 2nd joint about equal to all the other joints together. *Uropod* 2, outer ramus about $\frac{3}{4}$–$\frac{4}{5}$ length of inner ramus.

In the young from the brood-pouch, 4·5 mm. in length, the dorsal carination on pleon is scarcely developed. Side-plate 1 is blunt below as opposed to 2 and 3, which

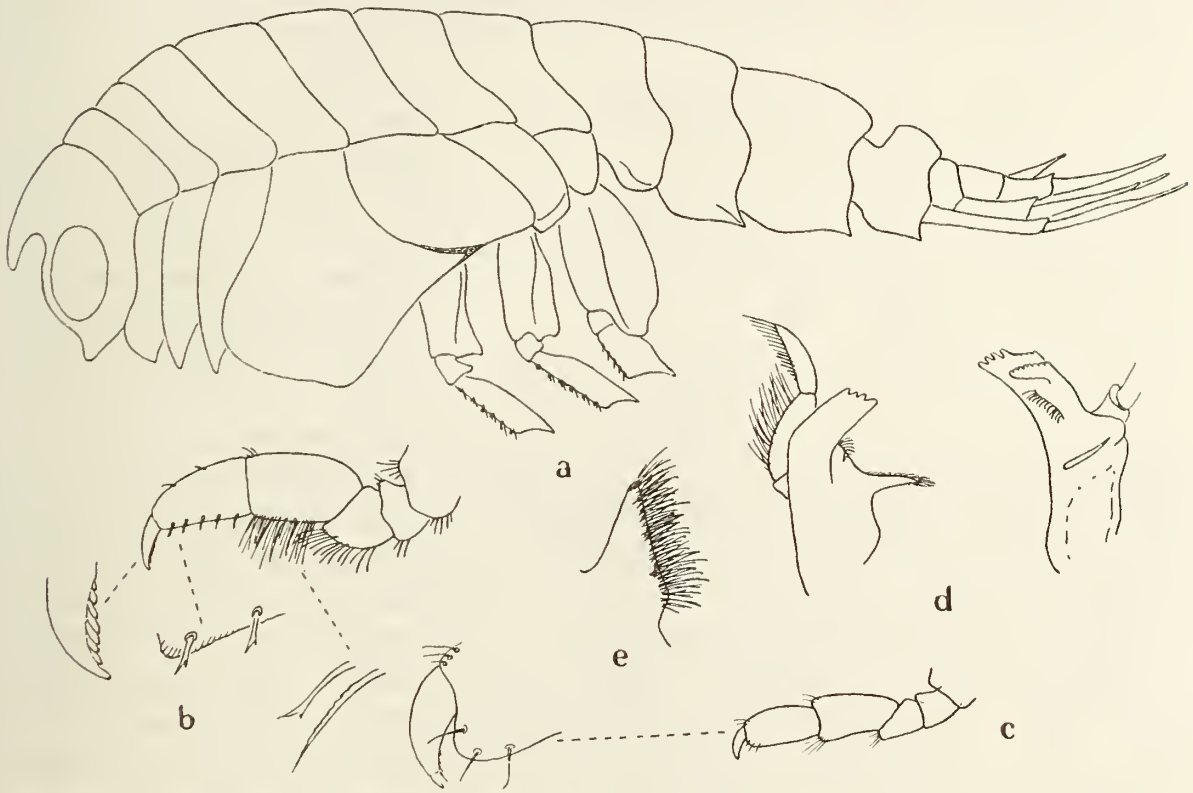

Fig. 44.—*Epimeriella walkeri*, n. sp. *a*, general view; *b*, gnathopod 1 of adult, with portions enlarged; *c*, gnathopod 1 of young from brood-pouch, with distal portion enlarged; *d*, inner and ventral views of mandible; *e*, molar process further enlarged.

are subacute. Rostrum as in adult. Gnathopods 1 and 2 with the 6th joint parallel-sided, with a distinct rounded palm. Peraeopods 3 and 4, postero-inferior angles of 2nd joint rounded, dactylus half length of 6th joint. Peraeopod 5 not conspicuously shorter than peraeopods 3 and 4, otherwise as in adult, dactylus half length of 6th joint. Mandible as in adult.

Remarks.—These specimens are differentiated from *macronyx* by the 4th side-plate, hand of gnathopods 1 and 2, and length of dactyli of peraeopods 3 and 4. Peraeopod 5 is considerably shorter relatively to peraeopods 3 and 4 than in *macronyx*, and the rostrum is better developed.

Family ATYLIDAE.

Stebbing, 1906, p. 327.

Gen. NOTOTROPIS, Costa.

Stebbing, 1906, pp. 329, 728 ; Stephensen, 1915, p. 46 ; Schellenberg, 1925, p. 148.

Nototropis reductus, n. sp. (Fig. 45.)

Occurrence.—Sta. 133, New Zealand ; 1 ♀ 5·5 mm.

Description.—*Body* compressed, carinate from tip of rostrum to end of composite pleon segment 5 and 6. *Rostrum* reaching to middle of 1st joint of antenna 1. *Eyes* moderate, oval. Post-antennal angle of head not acutely produced. *Peraeon* segments with the carina not ending in teeth. Side-plates crenulate and setulose on lower margins. *Pleon* segments 1–3 with carina ending in blunt teeth, the teeth becoming successively larger posteriorly ; segment 4 with basal depression but no notch, carina ending posteriorly in a moderately sharp tooth ; a similar smaller tooth on the composite segment 5 and 6. *Telson* ovate, lobes slightly dehiscent, apices acute, outer margin slightly indented subapically, with a submarginal stout spine in the same position, a few minute setules on lateral margin.

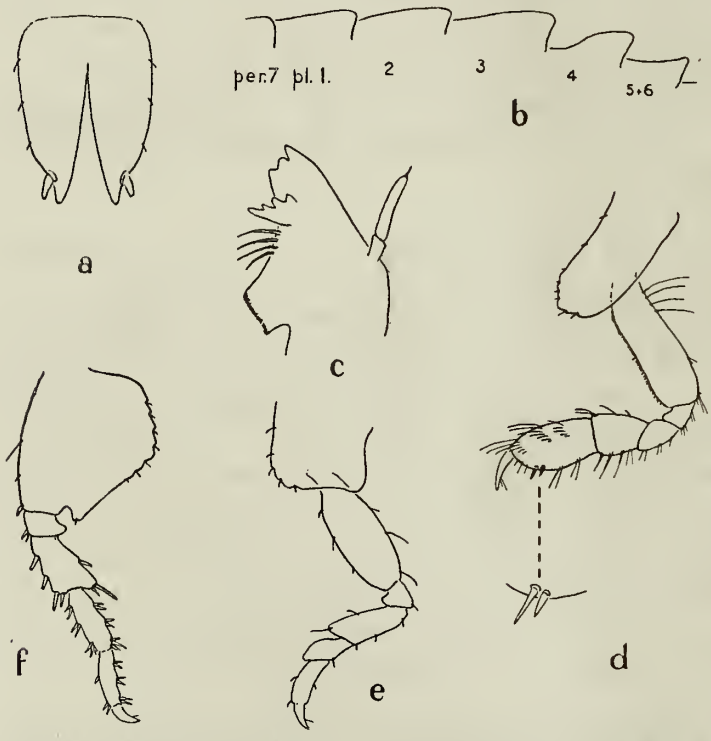

Fig. 45.—*Nototropis reductus*, n. sp. *a*, telson ; *b*, profile of dorsum of peraeon segment 7 and pleon segments 1–6 ; *c*, mandible ; *d*, gnathopod 1 ; *e*, peraeopod 2 ; *f*, peraeopod 5.

Antenna 1 rather stout, without apical tooth on 1st joint, 2nd joint subequal to 1st, more slender, 3rd shorter, flagellum 12-jointed, with filamentous sensory setae. Antenna 2 slightly longer than antenna 1, 5th joint more slender and longer than 4th, flagellum 7-jointed, each joint with a rather stout curved spinule on lower apex. *Mouth-parts* as in *homochir*, but palp of mandible reduced to 2 joints and not extending beyond cutting edge, the 2nd joint twice as long as 1st and tipped with one seta. *Gnathopods* 1 and 2 as in gnathopod 1 of *swammerdamei* (Sars, 1895, pl. 163), the 5th and 6th joints slightly more elongate in gnathopod 2 than in gnathopod 1, the anterior margin of 2nd joint with very fine setules. *Peraeopods* 1 and 2, 2nd joint rather stout,

5th joint in peraeopod 2 relatively much smaller than in peraeopod 1. Peraeopods 3 and 4, 2nd joint pyriform, not apically produced. Peraeopod 5, 2nd joint broadly expanded, hind margin sloping rather rapidly from the middle to the shortly produced apical angle, which carries a setule in a little notch, proximal part of hind margin serrulate, with setae in the notches, 4th–6th joints armed with stout spines and spinules. *Branchiae* simple. *Uropod* 3 not extending beyond apex of uropod 1.

Remarks.—The main features of this species is the reduced mandibular palp, a feature which may later necessitate the institution of a separate genus.

Chilton (1923, Tr. N.Z. Inst. liv., p. 242) has recorded *N. minikoi*, Wlkr., from New Zealand and West Australia.

Family MELPHIDIPPIDAE.

Stebbing, 1906, pp. 334, 728.

Gen. MELPHIDIPPA, Boeck.

Stebbing, 1906, p. 335 ; Schellenberg, 1926, p. 347.

Melphidippa antarctica, Schell.

? Walker, 1907, p. 34 (*macrura* non Sars.) ; Schellenberg, 1926, p. 347.

Occurrence.—Sta. 326, Antarctic ; 1 ♂ 16 mm.

Description.—Lateral angles of head rounded. *Eyes* hemispherically projecting, the ocelli well developed, arranged more or less radially, unpigmented (as preserved). Posterior margins of all *peraeon* segments smooth. Postero-inferior angle of segment 5 quadrate, 6 and 7 shortly produced and pointed. Side-plate 1 produced forwards, sharply pointed, lower margin crenulate or serrulate, with long setae ; lower margin of side-plate 2 scarcely crenulate, with long setae. Posterior margin of *pleon* segments 1–3 with numerous denticles extending laterally to the postero-inferior angle which ends in a small denticle. The medio-dorsal denticle on segment 1 not larger than any of the others, but about twice as large on segment 2, and on segment 3 twice as large as on segment 2. Segments 4 and 5 each with a large medio-dorsal tooth, flanked with denticles. *Antenna* 1, 2nd joint twice 1st, 3rd shorter than 1st, accessory flagellum 5–6 jointed. Mandibular palp stouter than in *goesi* (Sars, 1895, pl. 169, *spinosa*). Inner plate of maxilla 1 with 20 setae. *Gnathopod* 1, 5th joint more strongly produced even than in *goesi*. Gnathopod 2, 5th joint shaped as in *macrura* (Sars, pl. 170, fig. 1). *Peraeopods* 3–5 considerably more slender than in any of Sars' figures, 2nd joint scarcely wider than basal joints of the antennae. Telson, antenna 2, and uropods missing.

Remarks.—This form appears to be a valid species, combining the pleon armature of both *goesi* and *macrura*, and being separated from all the other species by the size and development of the eye, thus approximating to *Melphidipella*.

Whether Schellenberg's suggestion that Walker's specimen was wrongly identified is correct or not cannot be determined without re-examination of the specimen. One

would be inclined to suspect that Schellenberg is right, yet the main character separating *antarctica* from *macrura*, viz. the denticles on the *lateral* margins of the 1st–3rd pleon segments, is very obvious and can be observed without any dissection.

Distribution.—"Gauss" winter station, 385 metres.

Family EUSIRIDAE.

Stebbing, 1906, pp. 338, 728.

Gen. EUSIRUS, Kroyer.

Stebbing, 1906, pp. 338, 729; Chilton, 1912, p. 489.

Eusirus antarcticus, Thoms. (Fig. 46, *a*, *b*.)

Stebbing, 1906, p. 340; Walker, 1907, p. 30 (*propinquus* non Sars); Chevreux, 1911, p. 405, fig. 3 (*bouvieri*); Chilton, 1912, p. 490; Schellenberg, 1926, p. 348; ? Chevreux, 1906, p. 49, figs. 27–30 (*laticarpus*).

Occurrence.—Antarctic: 1. Sta. 220, 2 ♀♀ 24 and 27 mm. (the larger with young in brood pouch). 2. Sta. 269, 1 immature 13 mm. 3. Sta. 318, a lot, mostly ♀♀, but not ovigerous, 23–27 mm. 4. Sta. 321, 1 ♂ 24 mm. 4. Sta. 326, 1 ♂ 21 mm. 6. Sta. 331, 1 ovigerous ♀ 13 mm. 7. Sta. 348, 1 ♀ 24 mm. 8. Sta. 355, 1 ovigerous ♀ about 25 mm. (end of pleon missing).

Fig. 46.—*a*, *b*, *Eusirus antarcticus*, Thoms., 4th side-plate of adult and young; *c*, *E. perdentatus*, Chevr., 4th side-plate.

Remarks.—The somewhat conflicting accounts of this species are to be explained apparently by changes during growth and also by a certain amount of variability. In the young from the brood-pouch, 2·5 mm. in length, the telson is cleft for $\frac{1}{3}$, but in the two adults of No. 1 only for $\frac{1}{6}$ of its length. In the ♂♂ the actual notch only extends for $\frac{1}{6}$, but a pale semitransparent line indicates the extent of the cleft when the animal was younger. Schellenberg finds the telson cleft for $\frac{1}{4}$ of its length in both sexes.

Chevreux and Chilton agree in finding ♀♀ with the antennae longer than in ♂♂. Schellenberg finds no differences between the sexes, the 1st antenna reaching to end of the peraeon; in the "Nimrod" specimens already examined by Chilton, I find that antenna 1 reaches to end of peraeon segment 6 (which I should not consider as "short," as does Chilton, 1912, p. 491). In the two "Terra Nova" ♀♀ from No. 1, antenna 1 only reaches to end of peraeon segment 4; in the ♂♂ to end of peraeon segment 6. Sexual difference in the antennae has only been noted in *minutus* and *laticarpus*; in the former it is the ♂ (Sars, 1895; Stebbing, 1906), in the latter the ♀, which is stated to have the longer antennae.

The hind margin of pleon segment 3 is serrate both in the " Nimrod " and the " Terra Nova " specimens. Schellenberg found it so in both sexes, whereas in *laticarpus* ♀ and *bouvieri* ♀ it was only crenulate. In No. 2, here it is only crenulate. The serrations are frequently continued round the angle as in Stebbing's figure (1888), but even further along the lower margin ; this is especially noticeable in No. 6.

The character of the 4th side-plate has not been specially mentioned. The " Nimrod " and " Terra Nova " specimens agree with the " Challenger " specimen figured by Stebbing (1888, pl. 87, prp. 2) but are a little deeper ; the lower apex is rounded and the postero-inferior margin is straight, feebly serrulate. It is here figured to show the contrast with Chevreux's figure 27. If the latter is correct I think there is room for doubt whether *laticarpus* is the same species as *antarcticus*.

On the other hand, *bouvieri* does appear to be synonymous, as suggested by Chilton, 1912. The specimens here recorded agree with Chevreux's figure as regards the 4th pleon segment, i.e. the dorsal keel has a notch in the *middle*, provided that the segment is flexed at right angles to the 3rd segment ; if the pleon is extended, however, the notch appears to be at the base of the segment and at the anterior end of the dorsal keel.

The shape of the eye appears to be variable irrespective of sex. In some, e.g. No. 1, it is broadly oval, almost subcircular ; in others (No. 2) regularly reniform ; in others again (No. 4 ♂ and No. 6) lageniform, i.e. the upper part is conspicuously narrower than the lower part.

In view of the above it will be seen that it is not easy to draw a sharply defined diagnosis of the species *antarcticus*. The present material is not abundant enough, or in good enough condition to help very much towards a more detailed analysis of the " species."

Distribution.—New Zealand ; Kerguelen and Heard Islands ; McMurdo Sound ; South Orkneys and Coats Land ; " Gauss " winter station ; South Sandwich isles (*bouvieri*) ; Port Charcot and Marguerite Bay (*laticarpus*).

Eusirus microps, Wlkr. (Fig. 47.)

Walker, 1906, p. 152, and 1907, p. 31, pl. 11, fig. 19 ; Chevreux, 1913, p. 167 ; Schellenberg, 1926, p. 350.

Occurrence.—From Penguin stomach, December 1910, several specimens, more or less dismembered, about 35–45 mm.

Remarks.—One of the best preserved specimens is a ♂ nearly 45 mm. in length. It has elongate antennae and the very shallow telsonic notch as described by Walker. The 1st joint of antenna 1 has a series of little fascicles of setae on its lower inner margin, and the 4th joint of antenna 2 a similar series on its upper inner margin.

As the side-plates seem to be very characteristic a figure of them is given here, together with the 2nd joints of gnathopod 2 and peraeopods 1–5 to show the great relative slenderness of peraeopods 1 and 2.

There is also a smaller specimen (about 38 mm.) which is clearly a ♀; but there is no sexual difference in the length of the antennae, or the depth of the telsonic notch, such as is found in *laticarpus*.

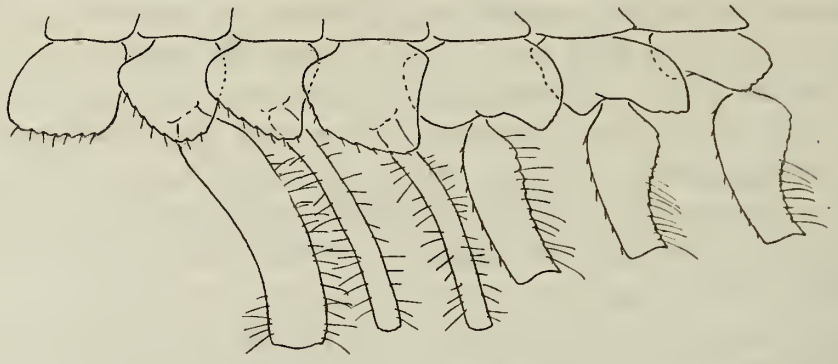

Fig. 47.—*Eusirus microps*, Wlkr. Side-plates 1–7 with the 2nd joint of gnathopod 2 and peraeopods 1–5.

One wonders whether *laevis*, Wlkr., 1903, is not the young of this species.

Distribution.—McMurdo Sound; Petermann Island; "Gauss" winter station.

Eusirus perdentatus, Chevr. (Fig. 46, *c.*)

Chevreux, 1912 (Bull. Mus. d'Hist. Nat. 1912, No. 4), p. 217 (publ. April or May); Chilton, 1912 p. 492, pl. 2, fig. 20 (*splendidus*) (publ. Sept.); Chevreux, 1913, p. 163, figs. 50–52; Schellenberg, 1926, p. 350.

Occurrence.—Antarctic: 1. Sta. 194, 1 ♂ 48 mm., 1 ♀ 52 mm. 2. Sta. 316, 4 ♂♂ 48–52 mm., 4 ♀♀ 50, 50, 53, and 70 mm., the largest apparently spent. 3. Sta. 338, 4 ♂♂ 47–48 mm., 2 ♀♀ 50 and 61 mm., and the front half of a large ovigerous specimen. 4. Sta. 355, 1 ♂ 43 mm., 1 juv. 25 mm.

Remarks.—Chilton in a footnote to his description of *splendidus* expresses his opinion that it is probably the same as *perdentatus*. I fully concur with this opinion. Chevreux figures the ♀, Chilton the ♂; but the latter scarcely does justice to a sexual difference which appears in the present specimens. This is the only sexual difference that I can find, and it seems to vary, being in some specimens not so conspicuous as in others. The 6th joint in peraeopods 3–5 is longer relatively in the ♂ than in the ♀, being sometimes equal to the 4th and 5th joints together. On the other hand, I do not find any noticeable difference in the length of the antennae or the depth of the telsonic notch. The difference in the size of the eyes, noted by Schellenberg, is in these specimens scarcely worth mentioning.

Neither Chilton nor Chevreux specially mention one feature which is found in these specimens, and which is apparently a constant character distinguishing this species from other species, e.g. those figured by Sars (1895). The 4th side-plate in the adult has a distinct, though not acute, angle below, and the postero-inferior margin is concave. In a young specimen, 25 mm. in length, the shape of this plate resembles that of the species figured by Sars, having the lower margin rounded and the postero-inferior margin straight.

The shape of the 1st side-plate in these specimens agrees with Chilton's figure more than with Chevreux's, the antero-inferior corner being strongly produced as a rounded lobe.

The teeth of the dorsal carina in the young specimen just mentioned are not so strong as in the adult, but are present from the 4th peraeon segment backwards.

One of the " Terra Nova " specimens is even larger than the " Gauss " specimens.

This species was not taken by the " Discovery " (1901–1904).

Distribution.—Palmer Archipelago, 60–70 metres ; South Orkneys, 54 fathoms ; " Gauss " winter station, 385 metres.

Gen. EUSIROPSIS, Stebb.

Stebbing, 1906, p. 343.

Eusiropsis riisei, Stebb. (Fig. 48.)

Stebbing, 1906, p. 343, figs. 80, 81 ; Walker, 1909 (Tr. Linn. Soc. Lond. Zool. XII.), pp. 324, 334 ; Schellenberg, 1926, p. 351.

Occurrence.—Sta. 53, Atlantic, North ; 3 ♂♂ 7 mm.

Remarks.—Walker's description of the 1st antenna and the presence of well-developed eyes, and Schellenberg's statement of the absence of an accessory flagellum, are confirmed.

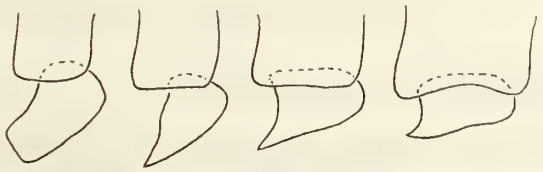

Fig. 48.—*Eusiropsis riisei*, Stebb. Peraeon segments 1–4 with their side-plates.

The two apical setae on the telson, as well as the two subapical ones, are plumose. Side-plates 1–4 all end posteriorly in a sharp point. The following feature does not appear from Stebbing's description : the lower margins of all the peraeon segments are quite free and overlap the bases of the side-plates. In spite of the last two features there is little room for doubt that the present specimens are conspecific with Stebbing's specimens.

Distribution.—Tropical and Southern Atlantic (22°–17° N. and 8°–35° S.) ; Indian Ocean (Seychelles).

Family PONTOGENEIIDAE.

Stebbing, 1906, p. 356 ; Schellenberg, 1926, p. 354 ; Stephensen, 1927, p. 315.

Gen. ATYLOIDES, Stebb.

Stebbing, 1906, p. 362 ; Stephensen, 1927, pp. 317, 324, 327.

Atyloides quadridens, n. sp.

Occurrence.—Sta. 331, Antarctic ; 2 ♂♂ 8–9 mm.

Description.—Agreeing in most respects with *magellanica* (Stebb.) as figured by Stebbing, 1888, pl. 79. Post-antennal angles of head strongly produced as acute

points. Eyes subcircular. Pleon segments 1 and 2 each with 2 short but distinct decumbent teeth on dorsal hind margin.

Remarks.—To a group of species already involved in considerable confusion and ambiguity, it is unfortunate to have to add another species. Schellenberg (1926, p. 360) has shown that *magellanica*, Chevr., cannot be the same as *magellanica* (Stebb.), and I would have accepted Schellenberg's interpretation of the latter and ranged the present two specimens as a variety of that species but for his statement that the post-antennal angles of the head are rounded and blunt. This certainly does not accord with the present specimens, and scarcely with Stebbing's figure, which, though very small, conveys the impression that the post-antennal angles are acute.

The feature of the dorsal teeth is present in neither Stebbing's nor Schellenberg's specimens, and induces me to propose a new specific name for the "Terra Nova" specimens. Future comparison, however, with Stebbing's types and more abundant material may show that *quadridens* is only a variety of *magellanica* (Stebb.).

Gen. PARAMOERA, Miers.

Stebbing, 1906, p. 363; Stephensen, 1927, pp. 317, 325, 327.

Paramoera serraticauda (Stebb.).

Stebbing, 1906, pp. 362, 729; Chilton, 1912, p. 497, and p. 497, pl. 2, figs. 21–23 (*calceolata*); Chilton, 1921, p. 224; Stephensen, 1927, p. 339.

Occurrence.—Sta. 220, Antarctic; 1 ♂ 7 mm.

Remarks.—The hind margin of pleon segment 3 has 7–8 serrations (cf. Walker, 1903, p. 58, pl. 11, fig. 90).

Distribution.—South Australia; Auckland Islands; South Orkneys; Cape Adare and McMurdo Sound; Graham Land.

Paramoera walkeri (Stebb.).

Walker, 1903, p. 58, pl. 11, figs. 91–97 (*Atylus antarcticus*, non Stebb., 1878); Stebbing, 1906, p. 728; Walker, 1907, p. 34; Chilton, 1909, p. 624; Chevreux, 1913, p. 169, figs. 53–55; Stephensen, 1927, p. 327 (in key to species).

Occurrence.—Antarctic: 1. Sta. 219, 1 ♂ 9 mm. 2. Sta. 321, 11 ♂♂ 9–11·5 mm. 3. Sta. 351, 1 ♂ 10 mm., 1 ♀ 12 mm.

Remarks.—Agreeing with Chevreux's figures rather than with Walker's as regards the 5th joint of gnathopods 1 and 2; the size of the 6th joint in both gnathopods in ♂ is larger than in Chevreux's ♀.

Distribution.—Cape Adare, littoral; McMurdo Sound, 3–10 fathoms; South Shetland Islands, littoral.

Family DEXAMINIDAE.

Stebbing, 1906, p. 514.

Gen. PARADEXAMINE, Stebb.

Stebbing, 1906, p. 518, and 1910, p. 602, and 1914, p. 366 ; Chevreux, 1906, p. 88.

Paradexamine pacifica (Thoms.). (Fig. 49, *a–c.*)

Stebbing, 1906, p. 518, and 1910, p. 602 ; Chilton, 1909, p. 632 ; Stephensen, 1927, p. 345, figs. 21, 22 ; non Chilton, 1912, p. 501 (=*fissicauda*, Chevr.).

Occurrence.—New Zealand : 1. Sta. 86, 3 ♂♂ 5·5–6 mm. 2. Sta. 89, 11 ♂♂ 5·5–6 mm. 3. Sta. 107, 20 ♂♂ 6–7 mm. 4. Sta. 109, 21 ♂♂ 5·5–7 mm. 5. Sta. 111, 4 ♂♂ 6 mm. 6. Sta. 120, 1 ♂ 6 mm.

Remarks.—These specimens would require little comment but for the fact that they conflict with the key given by Stebbing (1910) for distinguishing *pacifica* from *fissicauda*, and that Chilton (1912) has proposed to unite both these species.

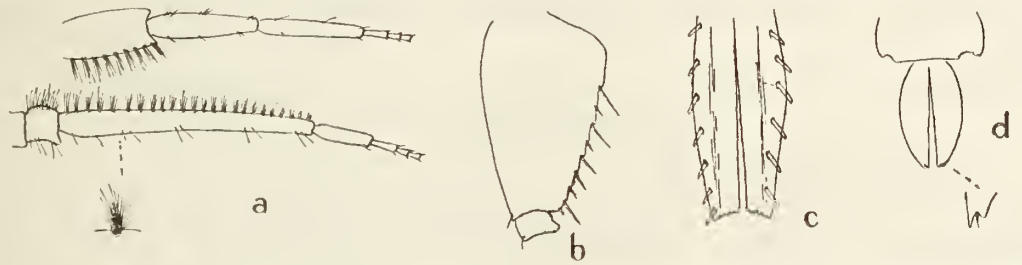

Fig. 49.—*Paradexamine pacifica* (Thoms.). *a*, antenna 1 and 2 ♂ ; *b*, peraeopod 5 ; *c*, telson ; *Polycheria antarctica* (Stebb.) ; *d*, telson.

The peraeon segments bear no dorsal teeth. The pleon segments 1 and 2 have 3 dorsal teeth each, the 4th segment a large medio-dorsal tooth.

The telson is actually cleft only for one-half its length, but the line of division can be traced almost to the base, and the two lobes can be easily separated without in any way damaging them. This shows that the extent of the cleft cannot be used to distinguish *fissicauda* from *pacifica*. On the other hand, one must not overlook the fact that Chevreux shows the apices of the lobes as subacute and without denticles. In the present specimens the apices are truncate with several little denticles, thus agreeing with Thomson's original description and Stephensen's figure. There is a slight medio-longitudinal keel along each lobe, and the asymmetry of the spines shown in the present figure is natural and frequent.

The rami of the 3rd uropod are used by Stebbing in his key (1910) to separate these two species ; the rami reaching beyond the telson in *fissicauda*, but not in *pacifica*. In these specimens, where the 3rd uropod is preserved, it has the rami large, lanceolate, and extending well beyond the apex of the telson (cf. Stephensen's figure).

These specimens are all ♂♂ ; Chevreux described and figured a ♀ ; neither Thomson nor Stebbing makes any mention of sexual dimorphism.

The antennae are furnished with dense fascicles of setae on the opposing surfaces of the peduncles, such as are found in the ♂ of, e.g., *Nototropis swammerdamei*.

The lateral angles of the head have a small acute point in front of the eye. Lower margins of side-plates 1–4 with little indents, each with a setule. The 5th peraeopod has the pyriform shape found in *pacifica*; the hind margin usually has a few strong outstanding spine-setae, with a smaller one between each pair.

Barring the fascicles of setae on the antennae and the long rami of uropod 3, both of which are clearly features of the ♂♂, these specimens are in perfect agreement with *pacifica*, and differ from *fissicauda* in the lateral angles of the head, peraeopod 5, and telson. These three characters seem to be essentially specific, whereas none of the characters mentioned by Chevreux (1906, p. 93) as distinguishing the two species in question appear to me to be really diagnostic.

On the evidence before me at present I am thus unable to agree to Chilton's contention that *fissicauda* is synonymous with *pacifica*, or to admit the cogency of his argument.

Distribution.—New Zealand; South-East Australia; Auckland and Campbell Islands.

Gen. POLYCHERIA, Hasw.

Stebbing, 1906, pp. 519, 735.

Polycheria antarctica (Stebb.) (Fig. 49, *d*.)

Chilton, 1912, p. 502 (literature and discussion); Schellenberg, 1926, p. 370, fig. 58; non Barnard, 1916, p. 211 (=*atolli*).

Occurrence.—Sta. 135, New Zealand; 3 ♂♂ 3–4 mm., 1 juv. 2·5 mm.

Remarks.—Although it may be convenient to have several forms united under one name, there is often a danger that specimens may be recorded without an indication of which form they represent, and thus possibly confusing the issue when it is desired to discover whether any particular form is confined to a particular geographical region.

Schellenberg (1925, p. 157) declines to follow Chilton in uniting *atolli* with *antarctica*, and records specimens from South-West Africa as *atolli*. The South African specimens, recorded by me as *antarctica*, should really have been referred to *atolli*, as they all possess the 1-jointed, apically truncate and denticulate palp of maxilla 1 characteristic of the latter species. A 1- or 2-jointed maxillary palp is often regarded as a generic distinction (e.g. *Phoxocephalidae*) though there is no reason why in every family it should be granted generic or even specific importance. But in this case the form of the maxillary palp is so entirely different in *antarctica* (*see* Stebbing, 1888, pl. 83) and in *atolli*, that Schellenberg's objection to a wholesale "lumping" is not surprising.

Thus is would seem that the form *atolli* is found in the Maldive Islands, Seychelles, Wasin (Brit. East Afr.), and in South and South-West Africa. This is not the place to discuss whether the form *antarctica* is also found in South Africa.

The present specimens are of the typical *antarctica* form : the maxillary palp is apically rounded and setose ; the carination of the pleon is feeble (cf. Schellenberg, 1927, fig. 58, *b*) and the 4th side-plate is feebly pointed.

The telson, however, is quite different from that figured by Stebbing (1888, pl. 83) and seems worthy of a figure. It is ovate (the two halves taken together) and entirely unarmed except for a minute spinule in the minute apical notch on each lobe.

Distribution (*antarctica* form).—Antarctic and Subantarctic, New Zealand, South and South-East Australia.

Family PHOTIDAE.

Stebbing, 1906, pp. 603, 737, and 1910, p. 608.

Gen. HAPLOCHEIRA, Hasw.

Stebbing, 1906, p. 609.

Haplocheira barbimanus (Thoms.).

Stebbing, 1906, p. 609, figs. 104, 105 ; Walker, 1907, p. 35 ; Chilton, 1912, p. 510 ; Schellenberg, 1926, p. 375.

Occurrence.—Sta. 331, Antarctic ; 3 ♀♀ 6–7 mm.

Distribution.—New Zealand ; South-East Australia ; Kerguelen ; South Orkneys, Falkland Islands ; McMurdo Sound, 0–222 metres.

Gen. EURYSTHEUS, Bate.

Stebbing, 1906, pp. 610, 738 ; Schellenberg, 1925, p. 176, and 1926, p. 375.

Eurystheus distichon, n. sp. (Fig. 50.)

Occurrence.—Sta. 220, Antarctic ; 1 ♂ 9 mm.

Description.—Lateral lobes of *head* not strongly produced, rounded. *Eyes* oval. Epistome with strong outstanding spine. Side-plates not dentate. No dorsal teeth on pleon. Postero-inferior angle of pleon segment 3 rounded. *Telson* triangular, apex narrowly rounded, two parallel longitudinal bands of minute spinules on distal half. *Antenna* 1, 1st joint shorter than 3rd, 2nd longest, accessory flagellum 4-jointed. Mandibular palp with 3rd joint shorter than 2nd, obovate. *Gnathopod* 2, palm oblique, with a squarish tooth near hinge and a rounded one between it and the palmar angle, which is slightly greater than a right angle. *Peracopod* 3 stout, 2nd joint broadly oblong, hind margin concave in middle, postero-inferior angle rounded with a series of fine corrugations perpendicular to the margin, 4th joint very broad, dactylus strong. Peracopods 4 and 5, 2nd joint oblong, slightly wider proximally than distally, hind margin straight, postero-inferior angle quadrate. *Uropod* 3, peduncle with 1 stout spine on inner distal apex, and 3 in middle of upper distal margin, rami short and stout,

inner with 2 spines on inner margin and 1 on outer, outer ramus with 2–3 spines on upper outer margin, apical spinules small.

Remarks.—The outstanding peculiarity of this species is the telson with its two bands (*distichon*) of minute spinules. The only other species exhibiting a similar peculiarity is *exsertipes*, Stebb.; but in this latter species the bands of spinules are arranged nearer to and parallel with the margin. It is also a little uncertain whether these spinules are on the dorsal or ventral surface, because the word "below" in Stebbing's description (1888, p. 1097, and 1906, p. 615) may be taken to refer either

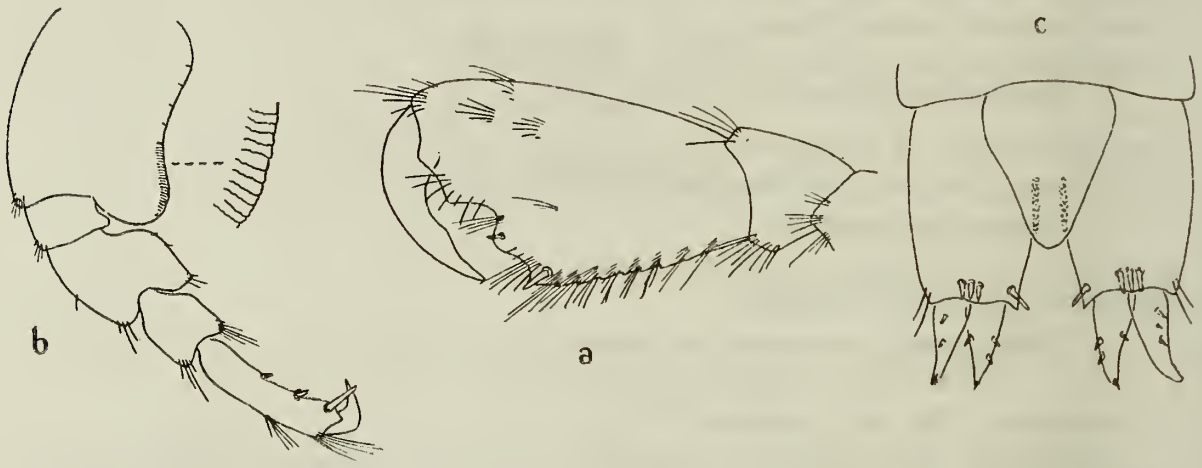

Fig. 50.—*Eurystheus distichon*, n. sp. *a*, hand of gnathopod 2; *b*, peraeopod 3; *c*, telson and 3rd uropods.

to that portion of the margin *posterior* to the spine and feathered cilium, or to the ventral surface of the margin.

If the spinules are on the dorsal surface in *exsertipes*, no great importance is to be attached to their slightly different position in *distichon*. There are, however, several other features distinguishing the present species, viz. the epistomal spine, non-dilated 2nd joint of gnathopod 2, 2nd joint of peraeopod 3, shape and armature of uropod 3.

Family JASSIDAE.

Stebbing, 1906, p. 647.

Gen. JASSA, Leach.

Stebbing, 1906, pp. 652, 739.

Jassa falcata (Mont.).

Chilton, 1912, p. 511; Schellenberg, 1926, p. 383; Monod, 1926, p. 61, fig. 58.

Occurrence.—Sta. 220, Antarctic; 1 ♀ 4 mm.
Distribution.—Almost cosmopolitan.

Gen. ISCHYROCERUS, Kröyer.

Stebbing, 1906, pp. 657, 739 ; Barnard, 1916, p. 264.

Ischyrocerus anguipes, Kröy.

Var. *longimanus*, Hasw.

Stebbing, 1906, p. 648 (*Wyvillea longimanus*) and p. 658 ; Chilton, 1921, p. 227 ; Stephensen, 1927, p. 353 (*Wyvillea longimanus*).

Occurrence.—Sta. 135, New Zealand ; 1 ♂ 3·5 mm.

Remarks.—Although Chilton has identified Australasian specimens with Kröyer's species, it is evident from the figures of the 2nd gnathopod given by Haswell and Chilton, with which the present specimen agrees, that there is a certain constancy in the development of the tooth at base of the 6th joint and the rounded apex of 4th joint. Such constancy deserves to be recognised, and I propose to regard the Australasian form as a definite variety under Haswell's name.

I should have been inclined to give it full specific rank, but that the South African form (Barnard, 1916, p. 264) resembles *longimanus* in regard to the 4th joint, though not as regards the 6th joint. The South African form has its own distinctive character in that the 5th joint is produced into a knob or process, and might be considered to deserve its own varietal name.

Distribution (var. *longimanus*).—South-East Australia ; New Zealand ; Auckland Islands.

Family COROPHIIDAE.

Stebbing, 1906, pp. 662, 739.

Gen. COROPHIUM, Latr.

Stebbing, 1906, pp. 685, 740 ; Barnard, 1916, p. 272 ; Chevreux and Fage. 1925, p. 363.

Corophium bonellii (M. Edw.).

Stebbing, 1906, p. 691 ; Chevreux and Fage, 1925, p. 369, fig. 377 ; Stephensen, 1924 (Vid. Medd. Dansk. Naturf. Foren. lxxviii.), p. 73 ; Stephensen, 1929 (Tierw. Nord. Ostsee), p. 169, fig. 40, sp. 314.

Occurrence.—Sta. 47, Atlantic, North ; 1 ovigerous ♀ 4 mm. (mutilated).

Remarks.—Antenna 2 and peraeopod 5 are missing, so that the diagnostic characters relied upon by Stephensen and Chevreux and Fage respectively to distinguish *acherusicum* from *bonellii* cannot be used. The former species is known from the Azores and off the coast of Senegal (Chevreux, 1900, p. 109). The present specimen has the antero-lateral angles of the head rounded.

Distribution.—North Atlantic ; Alaska. Other localities doubtful (Stephensen, 1924, p. 78).

2. HYPERIIDEA.

A. HYPERIIDEA GAMMAROIDEA.

Tribe PRIMITIVA, Wolt.

Subtribe COMPLETA, Wolt.

Family ARCHAEOSCINIDAE nom. nov.

Woltereck, 1909, pp. 147, 156 (*Pygmaeidae*); Stephensen, 1925 a, p. 243 (*Pygmaeidae*).

Woltereck (1909) included in his subtribe *Completa* the two families *Pygmaeidae*, Wolt., and *Lanceolidae*, Bov. The former family includes the genera *Archaeoscina*, Stebb., 1904, *Micromimonectes*, Wolt., 1907, *Mimonecteola*, Wolt., 1909, and *Microphasma*, Wolt., 1909.

Although there are no representatives of any of these genera in the present collection, it may be remarked that the name "Pygmaeidae" is nomenclatorially inadmissible as there is no genus "Pygmaeus" from which the family could take its name. True, Woltereck (1909, p. 147) recognised that each of the genera in question really demanded the institution of a separate family, though he united them in the one "Sammelbegriff." But he also used the word "Pygmaeidae" as a definite family name and printed it in italics (pp. 145, 147, 153, 154, 156). Stephensen lists it as such in 1925.

It would be correct and much better to take the family name from Stebbing's genus, as above. Additional family names can be made from the other genera, if thought necessary, when further material of these interesting forms comes to hand.

Subtribe INCOMPLETA, Wolt.

Family MIMONECTIDAE.

Bovallius, 1889, p. 59; Woltereck, 1909, p. 147 (*Eumimonectidae*); Stephensen, 1923, p. 5 (*Eumimonectidae*), and 1925 a, p. 244 (*Eumimonectidae*).

There is clearly no reason for substituting a newer name for the original name, based on the first described genus, given by Bovallius.

The family includes the genera *Mimonectes*, Bov., *Sphaeromimonectes*, Wolt. (June 1904) and *Parascina*, Stebb. (November 1904). Woltereck (1909, p. 151) has remarked on the very close agreement between *Sphaeromimonectes*, especially *S. diomedeae*, and *Parascina fowleri*, and has expressed his uncertainty as to the application of the Law of Priority in this case where the extreme forms of a series of species have been described under different generic names in the same year. There is really no difficulty, as *Parascina* was described five months after *Sphaeromimonectes*, if the two are to be regarded as synonymous. In spite of Woltereck's remarks, and the structure of the mouth-parts, Stephensen (1918, p. 17, and 1925 a, p. 244) includes *Parascina* among the *Scinidae*.

The question of the validity of *Parascina* demands a few comments. *Sphaeromimonectes* has typically a delicate and transparent cuticle. The dorsal and ventral surfaces of the peraeon in ♀ are more or less swollen. In the single known ♂ (*S. valdiviae pacifica*) the peraeon is not swollen. One may regard the swollen body form in ♀ as normal, though one frequently comes across specimens of Hyperiids in which the segments are swollen as the result of the method of preservation ; and the swollen ventral surface is often found in ♀♀ full of eggs ready to be discharged into the brood-chamber. But this was not the case, apparently, in the specimens examined by Woltereck.

S. diomedeae, on the other hand, has a stronger and deeply pigmented cuticle, and no swelling of the peraeon segments either dorsally or ventrally, though the single specimen is stated to be a ♀. This latter statement may perhaps be doubted, as the 2nd antennae are moderately well developed and similar to those of *Parascina* ♂ (cf. Stephensen, 1918, fig. 5).*

Assuming, therefore, that Woltereck's specimens were normal and that *S. diomedeae* was based on a ♀, the swollen peraeon is a noticeable difference between *Sphaeromimonectes* (including the species *valdiviae, gaussi, scinoides, cultricornis*) on the one hand, and *Parascina fowleri* and *S. diomedeae* on the other hand (Woltereck, 1909, p. 151). The differences in the maxillipeds would appear to be of quite minor importance (cf. the specific differences in the various species of *Scina*). In contrast to the differences noted by Woltereck, the following points of resemblance may be noted : the rather swollen and glandular 5th joint of peraeopods 3 and 4, which may prove to be a point of difference between *Parascina* and *Sphaeromimonectes* (Woltereck's figures, 1904, 1906, 1909 are not conclusive).

I would propose, therefore, that *Parascina* be maintained as a valid genus, but that *S. diomedeae* should be transferred to it, a course which Woltereck himself was seemingly inclined to adopt (*l.c.*, p. 151). To these I propose to add as a third species the form described below.

It is a great pity that detailed descriptions and figures of the appendages of the species of *Sphaeromimonectes* are not available, and that additional material has not been procured by more recent expeditions.

Gen. PARASCINA, Stebb.

Stebbing, 1904, p. 20 (♀) ; Woltereck, 1909, p. 151 ; Stephensen, 1918, p. 17 (♂).

Parascina setosa, n. sp. (Fig. 51.)

Occurrence.—Sta. 178, Antarctic ; 1 ♂ about 5–6 mm.

Description.—Integument of peraeon segments with faint hexagonal markings as in some species of *Lanceola*.—First *antenna* similar to that of *fowleri*, but serrated

* There is more than one misprint or contradiction in Woltereck's 1909 paper, e.g. p. 151. *S. scinoides* is said to have been taken by the " Gauss " in the Atlantic ; it was described in 1906 as taken by the " Valdivia " in the Southern Indian Ocean.

on both inner and outer margins, and setose on dorsal surface. Apex broken. Second antenna apparently about half the length of 1st antenna if the latter were complete, consisting of 2 rather elongate joints, followed by 5 short ones bearing very long setae. Mouth-parts not observed. *Gnathopod* 1 similar to that of *fowleri* ♀ as figured by Stebbing, but the apical teeth at base of dactylus very small. Gnathopod 2 similar to gnathopod 1, but more slender.

Peraeopods 1 and 2 more slender than in *fowleri*, 5th joint glandular but not swollen, upper apex of 6th joint with a long seta extending beyond dactylus. Peraeopods 3 and 4 slender, 4th joint longer than 5th or 6th, especially in peraeopod 4 where it nearly equals the 2nd joint, 5th joint glandular as in *fowleri*, 6th not markedly slender as it is in *fowleri*, dactyli greatly reduced, apparently retractile. Peraeopod 5 slender, about

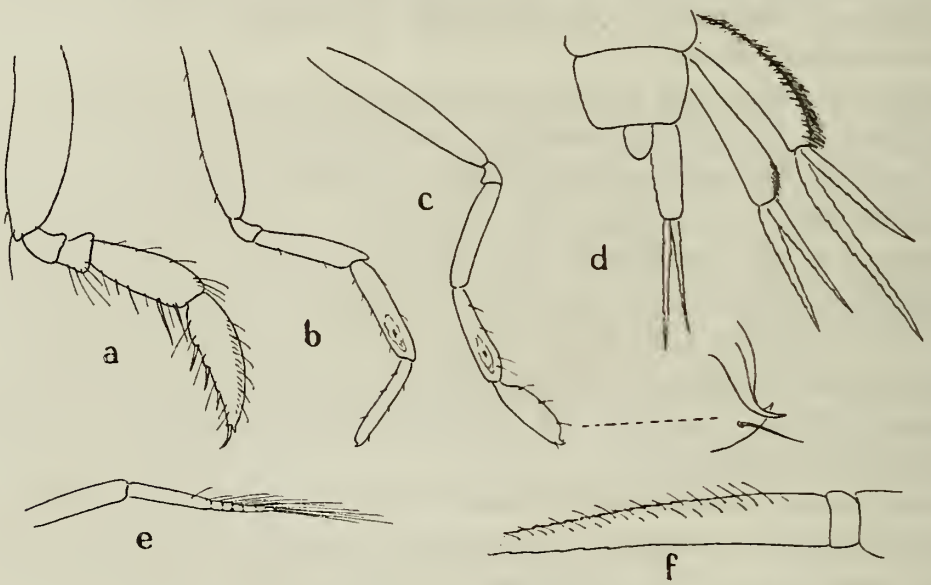

Fig. 51.—*Parascina setosa*, n. sp. *a*, gnathopod 1; *b*, peraeopod 3; *c*, peraeopod 5; *d*, telson and uropods 1–3; *e*, antenna 1; *f*, antenna 2 (tip broken off).

as long as peraeopods 3 and 4, 5th joint slightly widened distally, with a glandular cell as in peraeopods 3 and 4, 6th joint much shorter, wider, elongate-ovate, abruptly contracted at apex, where there appears to be a small projection overhanging the minute retractile dactylus (cf. *Lanceola*).

Uropod 1 extending beyond apices of uropods 2 and 3, peduncle long but stout, outer margin distinctly convex and set with a thick band of setae, outer ramus shorter than inner which exceeds the peduncle, outer margin setose, inner margin and both margins of inner ramus serrate. Uropod 2, peduncle widening a little distally, where there is a band of setae on outer margin, rami subequal, margins serrate except outer margin of outer ramus which is smooth. Uropod 3, peduncle serrate on inner margin, rami subequal, narrow, elongate, their margins serrulate. *Telson* apically rounded.

Remarks.—This very interesting specimen was in such a bad condition that it had to be dissected as far as possible in glycerine jelly and mounted straight away.

Several of the peraeopods were torn off or damaged, and the whole buccal mass was missing.

In spite of this, the specimen presents features so similar to those of *fowleri* that I have no doubt as to its being correctly placed in the genus *Parascina*. These features are, in particular : gnathopods 1 and 2, the glands in peraeopods 1–4, large 1st antenna, and small telson. On the other hand, the hexagonal markings of the integument and the retractile dactyli of peraeopods 3–5 are reminiscent of *Lanceola*. In any case there are features so distinctive that the institution of a new species is clearly indicated. Although the description is perforce incomplete, the characters of the uropods (whence the specific name) will render the species easily recognisable when further and better material is discovered.

Parascina fowleri, Stebb., is known from the North Atlantic, and *P. diomedeae* (Wolt.) from the Eastern Tropical Pacific ("Albatross," Sta. 4667). The present species constitutes an interesting extension of the known distribution of the genus.

Family LANCEOLIDAE.

Woltereck, 1909, p. 156 ; Stephensen, 1918, p. 8.

Gen. LANCEOLA, Say.

Stebbing, 1904, p. 28 (key to species) ; Woltereck, 1909, p. 157 ; Stephensen, 1918, p. 8.

Lanceola felina, Bov.

Bovallius, 1887, p. 38, pl. 5, figs. 14–23 ; Woltereck, 1909, p. 159, pl. 6, fig. 20 (1st antenna) (var. *longipes*) ; Chevreux, 1920, p. 2.

Occurrence.—Sta. 49, Atlantic, North ; 1 ♀ 10 mm.

Distribution.—Tropical and South Atlantic (Bovallius) ; N. Atlantic (46° N.) (Chevreux) ; Eastern Tropical Pacific (16° S.) (Woltereck).

Lanceola clausi, Bov.

Bovallius, 1887, p. 40, pl. 6, figs. 14–23 ; G. O. Sars, 1900 (Norw. N. Pol. Exp. i.), p. 15, pl. 1 ; Chevreux, 1920, p. 3 ; Stephensen, 1923, p. 4.

Occurrence.—Sta. 276, Antarctic ; 2 ♀♀ 6 and 7 mm.

Remarks.—These two specimens agree in all essentials with the descriptions and figures of Bovallius and Sars, except in the following particulars :

The slight ridge on the anterior margins of peraeon segments 3 and 4 is not present. The eyes apparently are quite obsolete. The setae on inner margins of lobes of maxillipeds are fewer, and the single seta on outer distal margin is not so isolated from the apical setae. The lower (hind) margins of 6th joint of gnathopods 1 and 2 are minutely serrulate between the insertions of the setae. The proportions of peraeopods 3–5 agree with Bovallius' figure, pl. 6, fig. 14 (i.e. peraeopod 4 is slightly longer than peraeopod 3), but not with his description or with Sars' description and figure ;

though in Sars as in Bovallius a slight discrepancy may be noted, namely, peraeopod 4 is figured as of the same length as peraeopod 3, whereas according to the description it should be slightly shorter. The inequality of these two peraeopods is less in the smaller specimen, though in both it is not so great as in Bovallius' figure. The telson has the slightly convex sides as in Bovallius' figure, but is shorter relatively to the peduncle of uropod 3 than in either Bovallius' or Sars' figures. The inner ramus of uropod 3 in the smaller specimen is distinctly narrower than in Sars' figure. There are only 3 peduncular joints in antenna 2, as in Bovallius, and Sars' figure 2 (Sars says there are 4 joints and figures them in fig. 4); the flagellar joint has no minute terminal joints.

The above differences do not seem to me to constitute a sufficiently cogent reason for regarding the southern specimens as specifically distinct from the northern form. Even if further and better material be obtained later and necessitate another specific name, it is obvious that the two forms are so closely allied that one may speak of another case of bipolarity.

Distribution.—Davis Strait, 72° N. (Bovallius); North Polar Seas, 80°–85° N. (Sars); coast of Portugal, Morocco and off the Canary Islands, 38°–27° N. (Chevreux).

Chevreux remarks that whereas this species was captured at depths of about 100–300 metres in the Polar seas, further south in the Atlantic it appears to live at greater depths (3000–4800 metres). Stephensen (*l.c.*) doubts the correctness of Chevreux's identification for geographic reasons.

PARALANCEOLA, n. g.

Like *Lanceola*, but antenna 2 with elongate filiform flagellum (cf. ♂ *Scina*), 3rd joint of mandibular palp longer than 1st and 2nd together, 5th joint of gnathopod 1 not distally expanded.

This genus is without doubt to be placed in the *Lanceolidae*, which will necessitate emending the family definition given by Woltereck (1909, p. 156) to the effect that the 5th and 6th joints of gnathopod 1 are typically, though not always, expanded.

Paralanceola anomala, n. sp. (Fig. 52.)

Occurrence.—Sta. 282, 1 (♂ ?) about 6 mm.

Description.—Whole *integument*, including antenna 1, trunk of mandibles, peraeopods and uropods, with hexagonal markings. *Rostrum* inconspicuous. Eyes minute, consisting of 4 ocelli with crystal cones. *Side-plates* well developed, 1st oblong with a rounded projection in front, 2nd, 3rd and 4th semicircular, but rather deeper than a true semicircle, 5th bilobed, much longer than deep, with subrounded projection behind, 6th scarcely as long as width of 6th segment, much shallower than 5th, rounded-oblong, 7th similar but smaller and considerably shorter than width of 7th segment.

Antenna 1 very short and stout, only 2 joints in peduncle, flagellum conical, with 2 inconspicuous minute joints at apex of main joint. Antenna 2 similar to that

of a ♂ *Scina*, last peduncular joint elongate, slightly enlarged distally, fringed with setules, flagellum very elongate, filiform, without visible division into joints. *Mandibles* with a narrow, serrate cutting-edge, palp with 3rd joint rather longer than 1st and 2nd together (cf. *Vibilia* and *Archaeoscina bonnieri*). *Maxilla* 1, with 4 strong spine-teeth on outer lobe, inner lobe not observed, palp rather narrow with an apical notch and 2 setules. Maxilla 2, outer plate with 4, inner with 3, apical spine-setae. *Maxilliped*, outer plates semicircular, inner margin straight, with a series of spine-like teeth, and

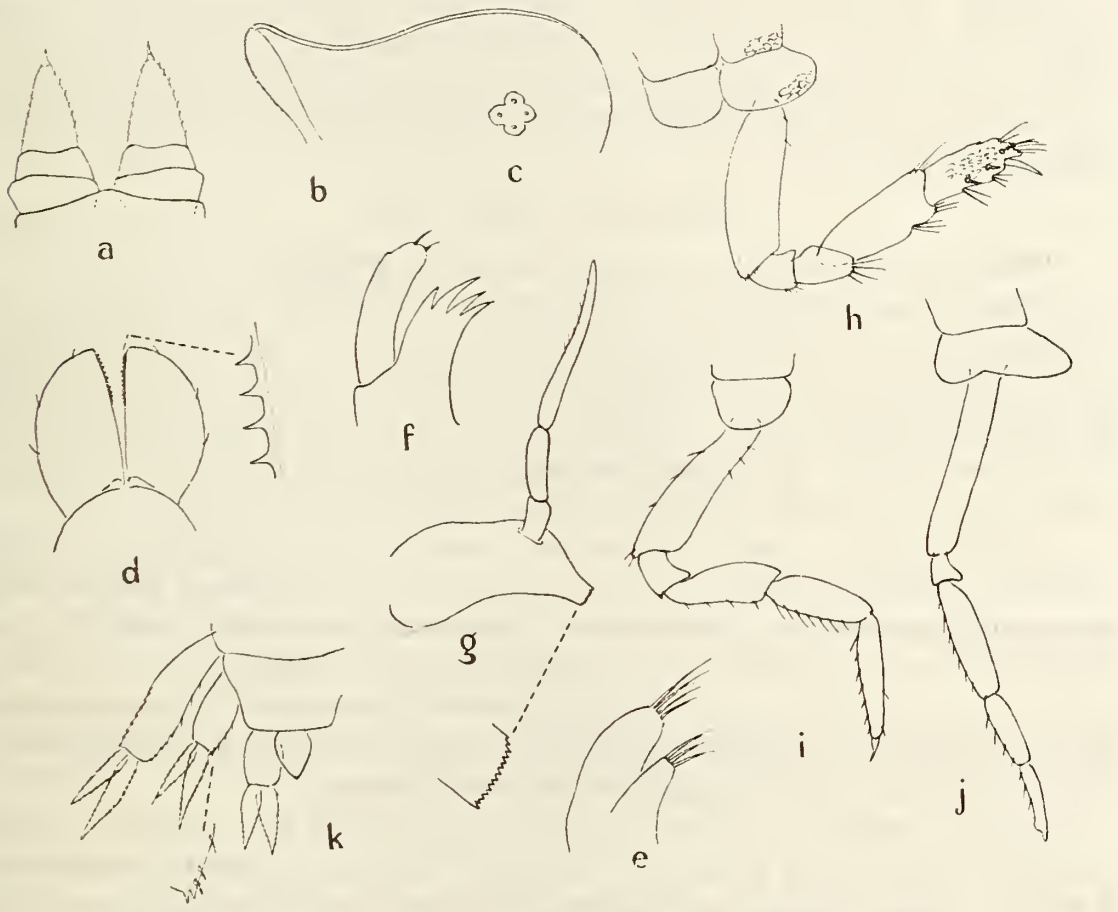

Fig. 52.—*Paralanceola anomala*, n. g., n. sp. *a*, dorsal view of 1st antennae; *b*, antenna 2; *c*, eye; *d*, maxilliped; *e*, maxilla 2; *f*, maxilla 1; *g*, mandible; *h*, gnathopod 1; *i*, peraeopod 1; *j*, peraeopod 3; *k*, telson and uropods 1–3.

2–3 setules on outer margin, inner plates apparently obsolete (cf. *Vibilia* spp.) *Gnathopod* 1, 5th joint cylindrical, scarcely expanded distally, 6th ovate, the upper apex overhanging insertion of dactylus. Gnathopod 2 similar but more slender and dactylus inserted terminally.

Peraeopods 1 and 2, dactylus short but well developed, exsert. Peraeopods 3–5, 3rd longer than peraeopods 1 and 2, 4th shorter than 3rd, 5th shorter than 4th and about the same length as peraeopods 1 and 2, dactyli retractile. *Uropods*, outer and inner margins of peduncle of uropod 1 distally serrate, as also inner apex of peduncle

of uropod 2, all rami serrate on both margins, serrations strong on inner margins, less so on outer margins, especially in uropods 1 and 2, where there are only a few slight notches. *Telson* triangular, sides convex, reaching nearly to apex of peduncle of uropod 3.

Remarks.—Like the specimen of *Parascina setosa*, this specimen could only be examined after dissection and mounting on a slide, owing to its damaged condition.

Along with the hexagonally marked integument and retractile dactyls of peraeopods 3–5, typical of *Lanceola*, it presents some curious anomalies, viz. mandibular palp like that of *Vibilia* or *Archaeoscina*, a maxilliped resembling that of certain species of *Vibilia*, a 2nd antenna resembling that of a fully adult ♂ *Scina*, and a gnathopod 1 more like that of ♂ *Parascina fowleri* (*see* Stephensen, 1918, fig. 5) than that of a typical *Lanceola*.

Tribe DERIVATA, Wolt.

This tribe contains the two families *Scinidae* and *Vibiliidae*.

There is another family, the *Cyllopodidae*, the great likeness of which to the *Vibiliidae* has been commented upon by several authors. Bovallius (1889, p. 3) would have "united them in the same family as two subfamilies if it was not for keeping up the congruity of the system"; which is no reason at all for separating them. The inferior position of the 2nd antennae might be regarded as important from a systematic point of view, but the size of the eyes certainly cannot (cf. *V. macropis*).

Stebbing (1888, p. 1295) questions the necessity of separating *Cyllopus* from the *Vibiliidae*. Woltereck (1909), who is responsible for an improved analysis of the relationships between the *Gammaroidea*, *Hyperiidea gammaroidea* and *Hyperiidea genuina*, makes no mention of the *Cyllopodidae* when assigning the *Scinidae* and *Vibiliidae* to the tribe *Derivata* in the *Hyperiidea gammaroidea*. Stephensen (1925) includes the family in the tribe *Recticornia* of the *Hyperiidea genuina*, following Bovallius (1890), but Spandl (1927) transfers it to the tribe *Filicornia*.*

Although Stebbing retained the family *Cyllopodidae* in his "Challenger" report, perhaps in deference to Bovallius, I have here ventured to sink the family in the *Vibiliidae*, making *Cyllopus* (and *Cyllias* if it should prove to be a valid genus) a genus of the latter family.

Family SCINIDAE.

Stephensen, 1918, p. 16; Wagler, 1926, p. 324 (revision of family).

Gen. SCINA, Prest.

Stephensen, 1918, p. 19; Wagler, 1926, p. 324 (key to species, p. 443).

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* As also the *Thaumatopsidae*. One would be inclined to suppose that the words "Tribus Recticornia" had been omitted at the head of p. 170, but that the *Paraphronimidae* have suffered the same transposition and are interpolated between the *Hyperiidae* and the *Anchylomeridae*. Perhaps Spandl was of opinion that the tribe *Recticornia* of Bovallius need not be retained.

Scina crassicornis (Fabr.).

Wagler, 1926, p. 324, figs. 2, 3.

Occurrence.—Atlantic, North : 1. Sta. 53, 1 ♀ 8 mm. 2. Sta. 58, 1 ♂ (immature) 8 mm. 3. Sta. 59, 1 ♀ 9 mm. 4. Sta. 63, 1 juv. 4 mm. 5. Sta. 64, 1 ovig. ♀ 11 mm. 6. Sta. 66, 2 ovig. ♀♀ 9 and 10 mm. New Zealand : 7. Sta. 139, 1 ♀ 10 mm.

Distribution.—Mediterranean ; Atlantic 64° N.–33° S. ; Indian Ocean ; Pacific (?).

Scina curvidactyla, Chevr.

Wagler, 1926, p. 328, fig. 4.

Occurrence.—Sta. 45, New Zealand ; 1 ♂ (immature) 8 mm.

Distribution.—Mediterranean ; Atlantic 49° N.–28° S. ; Northern Indian Ocean.

Scina borealis (G. O. Sars).

Wagler, 1926, p. 337, figs. 9–11.

Occurrence.—New Zealand : 1. Sta. 93, 1 ♂ (immature) 3 mm. 2. Sta. 139, 1 ♂ (immature) 4 mm. Antarctic : 3. Sta. 178, 2 ♀♀ 4 and 5 mm. 4. Sta. 270, 1 ♀ 3·5 mm. 5. Sta. 276, 2 ♀♀ 5–5·5 mm. 6. Sta. 285, 1 ♀ 4 mm., 1 ♀ (spent) 6 mm.

Distribution.—Mediterranean ; Arctic and Antarctic Seas ; Atlantic (Greenland and Norway to Canary Islands) south to 49° S. ; Indian Ocean.

Scina antarctica, Wagler.

Wagler, 1926, p. 381, fig. 33.

Occurrence.—Antarctic : 1. Sta. 178, 1 ♂ (adult) 3·5 mm., 1 ♂ (penultimate instar) 3 mm., 1 ♀ 3·5 mm. 2. Sta. 284, 1 ♀ 4 mm.

Remarks.—The specimen from Sta. 284 was at first regarded as *rattrayi*, but detailed examination showed that it was a transition between *rattrayi* and *antarctica*. The uropods are like those of *antarctica* and there are the two little spinules at the apex of 2nd joint of 7th peraeopod ; but peraeopods 1 and 2 are of the slender build found in *rattrayi*, and the proportions of the joints of peraeopods 3 and 4 are those of *rattrayi*, as also the absence of all but the distal spines from anterior margin of 2nd joint of 3rd peraeopod ; the dactyli of peraeopods 3 and 4 are intermediate in length between those of the two species, though that of 5th peraeopod resembles that of *antarctica*.

According to Wagler *antarctica* seems to be the cold-water form of *rattrayi*, but a few specimens were taken also in tropical waters, possibly at greater depths, but on this point Wagler apparently had no definite information. He gives 51° N. as the limit of *rattrayi*, but has overlooked the " Ingolf " records which extend the distribution to 62° 49′ N.

Further material may eventually show that *antarctica* cannot be maintained as a separate species, though the proportions of the joints in peraeopods 5 and 6 are quite distinctive in the two forms.

Family VIBILIIDAE.

Bovallius, 1887, p. 42, and 1889, p. 3 (*Cyllopodidae*); Behning, 1913, p. 211, and 1925, p. 479; Stephensen, 1918, p. 32.

As already mentioned, the *Cyllopodidae* as a separate family is here abolished and the genus *Cyllopus* (and *Cyllias* if valid) is included in the *Vibiliidae*.

Besides the characters mentioned by Bovallius (1889, p. 3) viz. the shape of the 1st antennae, the form of the head due to the great development of the eyes, and the displacement of the origin of the 2nd antennae from an anterior to an inferior position, the only distinguishing character between *Vibilia* and *Cyllopus* is the development of the 5th peraeopod.* In *Vibilia* the 2nd joint of this leg is always shorter than the remaining joints together, except in the young, and in *V. chuni*, and possibly also in *V. borealis* (Behning, 1913, key to species, but scarcely in Bate and Westwood's figure); the specimens of *chuni* are small (4–6 mm.) and may perhaps be juveniles. In *Cyllopus*, on the other hand, the distal joints form, even in the adult, a mere appendage to the proportionately very large 2nd joint.

But when we take *V. macropis* even these differences seem to break down. The eyes are unusually large for a *Vibilia*, especially a young individual, the 1st antennae are of the *Cyllopus*-type, the 2nd antennae arise in a subinferior position (Bovallius, 1887, pl. 8, fig. 1) in contrast to other true species of *Vibilia*, and the 5th peraeopod is "not fully developed, as the specimen examined is very young" (Bovallius, 1887, p. 52). Behning (1925, p. 480, figs. 3–11) also had a young specimen with undeveloped distal joints to the 5th peraeopod. In fact, the question arises whether *macropis*, instead of being a form intermediate between *Vibilia* and *Cyllopus*, is not actually a true *Cyllopus*. I think it is (*see* further, p. 408).

In my opinion *Cyllopus* may be regarded as a more highly specialised form in which the eyes have undergone increased development, while the 5th peraeopod remains in an arrested, juvenile condition. That the 5th peraeopod is subject to reduction is shown by *Vibilioides*, which has only 3 joints besides the large basal joint.

Vosseler (1901, p. 94) refers to the similarity between the *Paraphronimidae* and the *Cyllopodidae*, based on the form and size of the head, form and jointing of the antennae, and—"cum grano salis"—the form of the legs, and the smallness of the epimera which are only found in the adult ♀. The shape of the head of *Paraphronima* seems to me absolutely distinct from that of *Cyllopus*, and as regards the legs, especially gnathopods 1 and 2, the grain of salt is too large, I am sure, for the majority of systematists to swallow. The epimera of *Cyllopus* are well developed in both sexes, as shown in Bovallius' figures, and how Vosseler came to make the statement he did remains a puzzle.

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* Behning (1925, p. 479) mentions the "reduzierte 2 Extremität" as a distinguishing character. This seems to be a misprint for "7" There are other misprinted numerals in the same paper.

The three genera here included in the family are distinguished as follows:

1. Eyes often large but not occupying nearly whole head. Antenna 1 with broad laminate flagellum. Antenna 2 inserted anteriorly. Peduncle of uropod 3 shorter than that of uropod 1. Peraeopods 3 and 4 usually not much longer than peraeopods 1 and 2 (exceptions: *V. edwardsi* and *longipes*).
   (*a*) Peraeopod 5 with 5 joints besides the large basal one .. .. *Vibilia*
   (*b*) Peraeopod 5 with 3 joints besides the large basal one .. .. *Vibilioides*
2. Eyes occupying whole of head. Flagellum of antenna 1 not laminate. Antenna 2 inserted inferiorly. Peduncle of uropod 3 as long as or longer than that of uropod 1. Peraeopods 3 and 4 considerably longer than peraeopods 1 and 2. .. .. *Cyllopus*

Gen. VIBILIA, M. Edw.

Behning, 1913, p. 212 (key to species), and 1925, p. 479; Stephensen, 1918, p. 33.

As remarked below under *Cyllopus* (p. 405), *V. serrata*, Stewart, is not a *Vibilia*, and in my opinion *V. macropis* also should be regarded as a *Cyllopus*.

Vibilia robusta, Bov.

Behning, 1913, p. 215; Stephensen 1918, p. 37, fig. 9.

Occurrence.—New Zealand: 1. Sta. 110, 1 ♂ 17 mm., 1 ♀ 13 mm. 2. Sta. 118, 1 ♀ 13 mm. 3. Sta. 129, 1 ♂ 20 mm., 1 ♂ 16 mm.

Remarks.—As sexual differences seem to be very slight (Stephensen, pp. 37, 38) the sexes of the above specimens may not be determined correctly.

Distribution.—Atlantic, 43° N.–30° S.; Indian Ocean.

Vibilia viatrix, Bov.

Behning, 1913, p. 217, and 1925, p. 482, fig. 12; Stephensen, 1918, p. 41, fig. 13.

Occurrence.—Atlantic, North: 1. Sta. 61, 1 ♂ 5·5 mm., 1 ♀ 4·5 mm. 2. Sta. 68, 1 ♂ 6 mm., 4 ♀♀ 5–5·5 mm. New Zealand: 3. Sta. 101, 4 ♀♀ 5·5–7 mm. 4. Sta. 107, 2 ♂♂ 9 mm. 5. Sta. 109, 2 ♂♂ 8 mm., 1 ♀ 7 mm. 6. Sta. 127, 2 ♂♂ 7–8 mm., 3 ♀♀ 6–7 mm. 7. Sta. 129, 38 ♂♂ 8–9 mm., 3 ♀♀ 7–8 mm. 8. Sta. 130, 8 ♂♂ 7–8 mm., 3 ovig. ♀♀ 9–10 mm., 3 ♀♀ 6–7 mm. 9. Sta. 131, 3 ♀♀ 8–10 mm., 1 juv. 6 mm. 10. Sta. 141, 4 ♂♂ 7–9 mm., 1 ♀ 6·5 mm., 1 juv. 5 mm.

Remarks.—The large size of some of the specimens from the area north of New Zealand is remarkable, approximating more to the normal size of *propinqua*. They all possess, however, the heavy 4th joints in peraeopods 3 and 4, and the armature of the inner margin of outer ramus of uropod 1 typical of *viatrix*.

Distribution.—Mediterranean; Atlantic, 45° N.–35° S.; Indian and Pacific Oceans.

Vibilia stebbingi, Behn. and Wolt.

Behning, 1913, p. 217, and 1925, p. 482, figs. 13–22; Stephensen, 1918, p. 40, fig. 12.

Occurrence.—Atlantic, North: 1. Sta. 50, 4 ♂♂ 4 mm. 2. Sta. 58, 1 ♂ 4 mm., 2 ♀♀ 3·5 mm. 3. Sta. 59, 2 ♀♀ 3·5–4 mm. 4. Sta. 61, 1 ♂ 4 mm., 1 ♀ 3·5 mm. 5. Sta.

67, 2 ♂♂ 5 mm. New Zealand: 6. Sta. 85, 4 ♂♂ 4–4·5 mm., 14 ♀♀ 3·5–4·5 mm. 7. Sta. 92, 1 ♂ 4·5 mm., 1 ovig. ♀ 4 mm., 3 ♀♀ 3·5 mm.

Distribution.—Mediterranean; Atlantic about 35° N.–30° S.; Eastern Pacific.

Vibilia propinqua, Stebb.

Stebbing, 1888, p. 1279, pl. 147; Behning, 1913, p. 218, and 1925, p. 484, figs. 23-25; Stephensen, 1918, p. 43, fig. 14 (non Walker, 1907, p. 6=*antarctica*).

Occurrence.—Atlantic, North: 1. Sta. 58, 1 ♂ 8 mm. 2. Sta. 62, 1 ♂ 7 mm. New Zealand: 3. Sta. 93, 1 ♂ 10 mm. 4. Sta. 127, 1 ♂ 10 mm., 1 juv. 5 mm. 5. Sta. 129, 7 ♂♂ 9–11 mm., 2 ♀♀ 10–11 mm. 6. Sta. 139, 14 ♂♂ 8–10 mm., 5 ♀♀ 10–11 mm.

Distribution.—Mediterranean; Atlantic, 50° N.–34° S.; Indian Ocean; Eastern Pacific.

Vibilia antarctica, Stebb.

Stebbing, 1888, p. 1290, pl. 150 (juv.); Walker, 1907, p. 6 (*propinqua* non Stebb.); Behning, 1913, p. 219, and 1925, p. 486, figs. 26–31.

Occurrence.—1. Sta. 256, New Zealand; 2 ♂♂ 10–12 mm., 4 juv. 5–5·5 mm. 2. Sta. 269, Antarctic; 4 ♀♀ 7–8 mm.

Remarks.—From an examination of some specimens collected by the National Antarctic Expedition, 1901–1904 ("Discovery"), I feel convinced that the specimens from the same Expedition seen by Walker should really have been identified as *antarctica* (*see* Appendix I, p. 447).

The sharp distinction on the inner margin of the outer rami of uropods 1 and 2 between the 2–4 large distal teeth and the fine serration on the rest of the margin, is very marked and forms a good specific character separating this species from *propinqua*, resembling in this respect *stebbingi*.

The eyes, according to Behning (1925, p. 487), are poorly developed, the individual ocelli discernible only with difficulty or not at all. In the present specimens the eyes are quite well developed with the ocelli easily discernible; they only differ from those of most other species in being of a pale brown colour instead of a dark brown or blackish colour.

Distribution.—Antarctic; South Atlantic; South Pacific.

Vibilia armata, Bov.

Behning, 1913, p. 220, and 1925, p. 491, figs. 52-61 (synonymy); Stephensen, 1918, p. 46, figs. 15, 16, chart 6.

Occurrence.—New Zealand: 1. Sta. 118, 2 ♀♀ 4·5 and 6 mm. 2. Sta. 126, 1 ♂ 5 mm. 3. Sta. 238, 1 ♀ 7 mm.

Distribution.—Mediterranean; Atlantic, 53° N.–43° S.; Indian Ocean; Eastern Pacific.

Vibilia pyripes, Bov.

Behning, 1913, p. 221, and 1925, p. 494, fig. 62 ; Stephensen, 1918, p. 52, fig. 17, chart 15.

Occurrence.—New Zealand : 1. Sta. 93, 1 ♂ 5 mm., 1 ♀ (about same size). 2. Sta. 130, 2 ♂♂ 6 mm., 1 juv. 4 mm.

Remarks.—The ♀ from Sta. 93 was doubled up inside a *Salpa*, and was not extracted from its house for measurement.

Distribution.—Tropical and Subtropical Atlantic ; Indian and Pacific Oceans.

Vibilia chuni, Behn. and Wolt. (Fig. 53.)

Behning, 1913, p. 222, and 1925, p. 496, figs. 68–79.

Occurrence.—New Zealand : 1. Sta. 109, 1 ♀ 4·5 mm. 2. Sta. 139, 2 ♂♂ 5–6 mm.

Remarks.—In No. 1 the rami of uropod 3 are broken off ; the 2nd antenna has 5 joints and the specimen is therefore regarded as ♀.

The ♂ has not hitherto been known. It resembles ♀, but the head is a little gibbous in front, the eye is larger, somewhat pyriform (wider dorsally than ventrally), 2nd antenna is 7-jointed, and the inner ramus of uropod 3 is broader and apically rounded, its inner margin serrulate only on the middle third, being smooth basally and apically. The armature of inner margin of outer ramus of uropod 1 is the same as figured by Behning for the ♀, viz. large teeth on distal half, and fine ones on basal half.

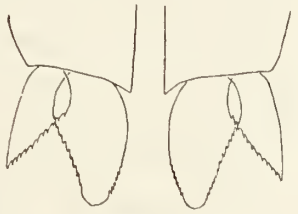

Fig. 53. — *Vibilia chuni*, Behn. and Wolt. ♂, 3rd uropods.

One cannot help being struck by the resemblance of *hodgsoni*, Stewart, 1913, to the ♂ of this species in certain respects, viz. the 5th peraeopod, the rami of the uropods (especially uropod 3), the large eye and the gibbous forehead. The hind corners of the last pleon segment also are said to be distinctly produced backwards (1913, p. 253), though the figure (pl. 6, fig. 6) scarcely does justice to this statement. In view, however, of Miss Stewart's statement that the hind margins of pleon segments 1–3 are feebly serrated, it is not suggested that *hodgsoni* is synonymous with *chuni*.

Distribution.—Atlantic (equatorial) ; Pacific.

Gen. CYLLOPUS, Dana.

Stebbing, 1888, p. 1296 ; Bovallius, 1889, p. 3 ; Stewart, 1913, p. 248 (*Vibilia serrata*) ; Spandl, 1927, p. 174.

Recent records of this genus are not numerous. Walker (1907) records *magellanicus*, Dana, from the Australasian quadrant of the Subantarctic. Miss Stewart describes a " *Vibilia* " *serrata*, but it is obviously a *Cyllopus*. Spandl records *armatus*, Bov., and describes *antarcticus*, n. sp., near to *lucasii*, but alleged to be distinguished from all the other species by the peculiar structure of peraeopod 2, the 5th joint being inserted laterally (externo-laterally) on the 4th joint which is distally produced. So

far from this being a peculiarity of this species, it is in fact found not only in all other *Cyllopus* species, but also in the species of *Vibilia*, as a glance at the figures of Bovallius, Stebbing, Stephensen, Behning would show. The species is clearly synonymous with *lucasii*.

In all we have nine described species. As a tenth I have no hesitation in transferring *macropis* from *Vibilia* to the present genus. Bovallius describes only two species from actual specimens; four other species are known only from the brief descriptions and figures, upon which latter absolute reliance cannot be placed, of the early authors Dana and Spence Bate.

Some remarks on general characters may be made. Whether the 5th and 6th pleon segments are coalesced or free seems to be not so much a specific character as a matter of individual observation. In the present specimens, for instance, while the dorsal transverse "convex groove" noted by Stebbing is obvious, there are sometimes also transverse creases and even internal muscle strands, which might easily give the impression of a definite transverse articulation between the two segments. I would not use the words used by Stebbing, but would describe the 6th pleon segment as being slightly concave basally, or lying at a lower level than the 5th, though the two segments are completely fused. This feature is shown in Stewart's fig. 6 of *serrata*, though the 5th and 6th segments are stated to be free. Stebbing is the only author who states that these two segments are coalesced.

Bovallius' figure 33 of *armatus*, in which segments are said to be free, is not very convincing, and as Stephensen (1918, p. 60) has shown in the case of *Thaumatops longipes*, Bovallius found a suture between two segments where Stephensen finds them fused. Spandl overlooks this feature in his description. In all the specimens I have examined these two segments are fused.

The carpus (5th joint) of peraeopod 2 is produced in all the species; in *levis*, Bovallius, both in his description and his figure, omits one of the joints, apparently the 5th, because the middle joint of those in the figure is evidently intended for the 4th joint with its setose enlargement.

Other characters, used by Bovallius, based as they are on brief descriptions and possibly defective drawings, are unreliable, as is likewise the presence or absence of serrations on the lower margins of pleon segments 1–3. As regards these latter, the specimens in the present collection show how variable these serrations are. But even where there is only one denticle, and where there are none at all, the corners of the pleura are always rounded; I have not found one in which it is quadrate in segments 1 and 2 as in *levis*.

From an examination of the present material, the following sexual differences and growth changes may be noted. In the ♂ besides the 1st and 2nd antennae, mentioned by previous authors, the 4th joint of gnathopod 2 is much less developed than in the ♀, the 6th joint of peraeopods 3 and 4 is slightly longer relatively to the 5th joint, the rami of uropod 3 are longer relatively to the peduncle, and the rami of

all three uropods, especially uropods 2 and 3, are broader than in the ♀ and tend towards a more ovate, less lanceolate shape. I have seen no specimens in which the inner ramus of uropod 2 has an actually rounded apex as in *levis*.

The following differences between the young and the adult are noticeable: the 2nd antenna consists of only 4 joints, the 5th joint of gnathopod 2 is not produced the 6th joint of peraeopods 3 and 4 is only $1\frac{1}{3}$ times the length of the 5th (as compared with $1\frac{1}{2}$–2 in the adult), the peduncle of uropod 3 is scarcely longer than the rami.

What characters, then, can we use to differentiate the species? The 5th joint of gnathopod 1 is definitely either broadly expanded and much wider than the 6th joint, or narrow and not much wider than the 6th joint. The 2nd joint of peraeopod 5 is either subtriangular, narrowing distally with the lower part of the hind margin concave, or ovoid, with the whole hind margin convex. The two species *lucasii* and *antarcticus* with broad 5th joints of gnathopod 1 and concave 2nd joints of peraeopod 5 can thus be separated from the other forms.

But there seem to be no further constant characters by which we can separate these other forms. The lower hind corners of pleon segments 1–3 are rounded in every species (and in all the present specimens) except in the single specimen described by Bovallius as *levis*, in which the corners of segments 1 and 2 are stated to be quadrate. This may be due to crumpling, as I have noticed that it is sometimes difficult to get the pleura to lie flat, especially when they are somewhat swollen due to the method of preservation. Bovallius, however, gives the large size of the 2nd joint of peraeopod 5 as an additional diagnostic character. I am inclined to attach less importance to this than to the quadrate corners of the pleon segments. The ovate inner ramus of uropod 2 is merely a sexual character.

For the present one may leave *levis* as a species, though personally I doubt whether it is more than a casual aberration of "the most common of all" species, described by Bovallius as *armatus*, though he suggested the possibility of its identity with Bate's *magellanicus* (renamed *batei* by Bovallius) and referred to the difficulty of finding diagnostic characters in this genus.

There can be no reasonable doubt that *armatus* is identical with *magellanicus*, Bate. Likewise *serrata*, Stewart, and also the juvenile *hookeri*, Stebb. The description of *danae* points out the differences between it and *lucasii*, but when it is compared with that of *magellanicus* no essential differences are manifest.

Lastly, there is *magellanicus*, Dana, which for three reasons is the most troublesome of all. Dana figured the posterior three side-plates as distinctly shallower than the preceding ones, the 2nd joint of peraeopod 5 as rather elongate, and cylindrical, and the rami of uropod 3 as scarcely shorter than the peduncle. If Dana's figure can be trusted (cf. Stebbing, 1888, p. 1300), then no other specimen has yet come to light showing any of the three peculiarities just mentioned. This is strong, though of course not conclusive, evidence that Dana's observations or drawings were faulty. In examining the present specimens I have noted that the junctions of the posterior

two or even three side-plates with their segments is often difficult to observe, though the junction of the 5th side-plate is usually distinct. The 5th peraeopod is much more flimsy than the other peraeopods and can easily be crumpled or deformed by the action of preserving fluids. The relative lengths of the peduncle and rami of uropod 3 is perhaps the one feature on which one might be disposed to place most reliance, as it does not conflict with more recent observations and merely indicates a juvenile stage.

Dana's material was small ("4 lines"=8 or $8\frac{1}{3}$ mm., not "13" mm. as Bovallius makes it), and errors were all the more likely, especially as regards the side-plates and 5th peraeopod. But as regards the 3rd uropod we find the same proportions of peduncle to rami in *macropis*, of which only specimens 4–6 mm. in length are known (Bovallius, 1887, p. 51, and Behning, 1925, p. 480). In the present collection young specimens have the peduncle very little longer than the rami, as noted above.

Reviewing the whole position, I submit that though we cannot be absolutely certain, the form found in abundance since Dana's time and described by various authors under the names *magellanicus*, Bate (=*batei*, Bov.), *danae*, Bate, *armatus*, Bov., *hookeri*, Stebb., *serrata*, Stewart, is in all probability the same as Dana's original species, and I propose to adopt this synonymy, including *Vibilia macropis*, Bov. This synonymy is no more extravagant than that of, e.g., *Parathemisto gaudichaudii*, in which forms differing far more one from another than is found in the forms of *Cyllopus magellanicus* are united by modern authors.

As the second species of the genus we have *lucasii*, Bate, with which *antarcticus*, Spandl, is evidently synonymous.

These two clearly defined species can be distinguished as follows:

1. 5th joint of gnathopod 1 not enlarged, 2nd joint of peraeopod 5 ovoid, hind margin convex .. .. *magellanicus*
2. 5th joint of gnathopod 1 broadened, 2nd joint of peraeopod 5 narrowing distally, hind margin distally concave .. .. *lucasii*

The genus *Cyllopus* is confined to the southern hemisphere, and has not been captured north of lat. 30° S. It extends polewards to 71° S.

Cyllopus magellanicus, Dana.

Dana, 1852, U.S. Expl. Exp. p. 990, pl. 68, fig. 1; Bate, 1862, p. 305, pl. 50, fig. 1, and p. 308, pl. 50, fig. 3 (*danae*); Bovallius, 1887, p. 51, pl. 8, figs. 1–8 (*Vibilia macropis*); Stebbing, 1888, p. 1296, pl. 209, fig. A (*hookeri*); Bovallius, 1889, p. 5, fig. (after Dana), p. 7 (*danae*), p. 10, pl. 1, figs. 1–35 (*armatus*), p. 14 (*batei*, nom. nov. for *magellanicus* Bate), p. 18 (*hookeri*). Walker, 1907, p. 7; Stewart, 1913, p. 248, pl. 4, and pl. 5, figs. 1–6 (*Vibilia serrata*); Behning, 1925, p. 480, figs. 7–11 (*V. macropis*); Spandl, 1927, p. 174 (*armatus*).

Occurrence.—New Zealand: 1. Sta. 206, 3 ♂♂ 9–10 mm. 2. Sta. 235, 1 ♀ (spent, or the ova fallen out) 11 mm. 3. Off Campbell Island. 26.iii.12. Plankton, night. 1 ♀ 7 mm. 4. Sta. 240, 1 ♀ 6 mm. 5. Sta. 250, 5 ♂♂ 10–11 mm. 6. Sta. 251, 37 ♂♂ 10–12 mm. 7. Sta. 252, 1 ♂ 8 mm. 8. Sta. 256, 1 ♀ (with uterine ova) 9 mm., 2 ♀♀ 7–8 mm., 1 juv. 4·5 mm. 9. Sta. 259, 1 immature (? ♀) 8 mm.

Remarks.—When the present collection is compared with some of the " Discovery " (1901–1904) specimens, there seems to be some indication of the correlation between large size and high latitude, but the material is too scanty to form a definite conclusion.

None of the present specimens show any trace of the pigment, either red, or black, or bluish-green, mentioned by Dana, Bate and Bovallius (*armatus*) respectively.

The most frequent associate of this species appears to be *Parathemisto gaudichaudii*.

Distribution.—South Atlantic; Indian and Pacific Oceans, between lat. 30° S. and 63° S.

Cyllopus lucasii, Bate.

Bate, 1862, p. 306, pl. 50, fig. 2; Bovallius, 1889, p. 16, fig. (after Bate); Spandl, 1927, p. 175, fig. 12 (*antarcticus*).

Occurrence.—Antarctic: 1. Sta. 285, 1 ♀ 16 mm. 2. Sta. 181. From Penguin Stomach. 22.xii.10. 1 ♀ 22 mm.

Remarks.—Spandl's figures are good, and without any doubt represent the same species as Bate described; but the margin of the process of the 5th joint of gnathopod 2, which is opposed to the serrate lower margin of the 6th joint, is serrate; and the inferior margin of the 6th joint of peraeopods 1 and 2 is pectinate as well as that of the 5th joint. The lower margin of the pleuron of pleon segment 1 is not strongly convex as it is on segments 2 and 3, but nearly straight, and there are no serrations at the rounded posterior corner. The pleura of pleon segments 2 and 3 are serrate on the rounded posterior corners.

Spandl's specimens were also taken from a penguin stomach.

Distribution.—Powel Island (=South Georgia); 65° S. 80′ E.

B. HYPERIIDEA GENUINA.

Family PARAPHRONIMIDAE.

Gen. PARAPHRONIMA, Claus.

Bovallius, 1889, p. 23 (key to species); Spandl, 1927, p. 165 (key to the two species nowadays recognised).

Paraphronima crassipes, Claus.

Bovallius, 1889, p. 30, pl. 2, figs. 11–15, and p. 33, pl. 2, figs. 16–40 (*clypeata*); Stewart, 1913, p. 253; Stephensen, 1924, p. 77, chart 10; Spandl, 1927, p. 166.

Occurrence.—Atlantic, North: 1. Sta. 65, 1 ♂ 8 mm. 2. Sta. 67, 1 ♂ 8 mm. 3. Sta. 68, 1 ♂ 7 mm., 1 ♀ 10 mm. New Zealand: 4. Sta. 92, 1 ♀ 8 mm. 5. Sta. 93, 1 ♂ 8 mm., 1 ♀ 10 mm. 6. Sta. 111, 1 ♀ 9 mm. 7. Sta. 133, 1 ♂ 7·5 mm. 8. Sta. 240, 1 ♂ 8 mm. 9. Off Campbell Islands. 28.iii.12. Plankton, night. 3 ♀♀ 7·5–9 mm., 1 adult ♀ 14 mm.

Remarks.—Nos. 8 and 9 extend the known distribution into considerably higher latitudes, not only in the S. Pacific and Atlantic, but in the N. Atlantic also; in the Atlantic the species is known between 42° N. and 37° S. The largest ♀ was caught in a high latitude.

Distribution.—Mediterranean; Atlantic; Pacific.

Family HYPERIIDAE.

Bovallius, 1889, p. 74 (key to genera); Stephensen, 1924, p. 78; Spandl, 1927, p. 151 (key to genera).

Gen. HYPERIA, Latr.

Bovallius, 1889, p. 129 (key to species); Vosseler, 1901, p. 56; Spandl, 1927, p. 153.

Hyperia fabrei (M. Edw.).

Bovallius, 1889, p. 206, pl. 10, figs. 40–55; Vosseler, 1901, p. 58, pl. 5, figs. 5–15; Stebbing, 1904, p. 34 (*vosseleri*); Stewart, 1913, p. 255 (*vosscleri*); Stephensen, 1924, p. 83; Spandl, 1927, p. 153.

Occurrence.—Atlantic, North: 1. Sta. 50, 58 ♂♂ 3 mm., 5 ♀♀ 2·5 mm. 2. Sta. 58, 6 ♂♂ 3 mm., 5 ♀♀ 3 mm. (1 ovigerous). 3. Sta. 59, 15 ♂♂ 3·5–4 mm., 1 ♀ 3 mm. 4. Sta. 61, 16 ♂♂ 4 mm., 4 ♀♀ 3 mm. New Zealand: 5. Sta. 93, 1 ♀ 3 mm. 6. Sta. 126, 1 ♂ (penultimate instar), 3·5 mm. 7. Sta. 127, 1 ♀ 3·5 mm.

Remarks.—The close and fine pectination on the front margin of the 6th joint of peraeopods 3–5 is well developed in ♂, but obsolete or nearly so in ♀. The species is new to the New Zealand area.

Distribution.—Mediterranean?; Atlantic, 41° N.–15° S.; Red Sea; Indian Ocean.

Hyperia luzoni, Stebb.

Stebbing, 1888, p. 1382, pl. 166 A; Vosseler, 1901, p. 64, pl. 5, figs. 16–28; Stebbing, 1904, p. 33; Stewart, 1913, p. 255; Stephensen, 1924, p. 84, fig. 34, chart 12.

Occurrence.—New Zealand: 1. Sta. 93, 1 ♂ (adult) 3·5 mm. 2. Sta. 126, 1 ♂ (penultimate instar) 3 mm. 3. Sta. 139, 4 ♂♂ (adult) 3·5 mm.

Remarks.—This species has already been recorded from the waters south of New Zealand by Miss Stewart, the specimens being collected on Scott's first Antarctic Expedition.

Distribution.—Mediterranean; Atlantic; Bay of Biscay to 28° S.; Pacific 16° N.–56° S.

Hyperia latissima, Bov.

Bovallius, 1889, p. 229, pl. 11, figs. 26–36; Vosseler, 1901, pp. 67 and 70, pl. 6, figs. 16–25 (*macrocephala*), and p. 74, pl. 6, figs. 26–28, pl. 7, figs. 1–5 (*hydrocephala*); Stephensen, 1924, pp. 91 and 92, chart 14 (*hydrocephala* and *macrophthalma*); Chevreux and Fage, 1925, p. 404, fig. 403.

Occurrence.—Atlantic, North: 1. Sta. 39, numerous adult ♂♂ 3·5 mm., ♂♂ in

penultimate instar 3 mm., ♀♀ 2–2·5 mm. 2. Sta. 40, numerous adult ♂♂ 3·5 mm., ♂♂ in penultimate instar 3 mm., ♀♀ 2·5 mm. 3. Sta. 43, 8 adult ♂♂ 3–3·5 mm.

Remarks.—Chevreux and Fage state that the ♂ resembles that of *schizogeneios*, i.e. with all segments distinct. The present specimens have segments 1–4 in ♂, 1–5 in ♀ coalesced.

The distribution is extended considerably to the south (23° S.) by these three hauls.

Distribution.—Mediterranean ; Atlantic, 26° N.–5° S.

Hyperia promontorii, Stebb.

Stebbing, 1888, p. 1385, pl. 166 B, and p. 1391, pl. 168 (*schizogeneios*) ; Bovallius, 1889, p. 214, pl. 11, figs. 3–13 (and ? p. 221, *schizogeneios*) ; Chevreux, 1900, p. 139, pl. 17, fig. 1 (*schizogeneios*) ; Vosseler, 1901, p. 64 and p. 66 (*schizogeneios*) ; Stewart, 1913, p. 255 (*schizogeneios*) ; Stephensen, 1924, p. 86, chart 13 (*schizogeneios*) ; Chevreux and Fage, 1925, p. 402, fig. 402 (*schizogeneios*).

Occurrence.—Atlantic, North : 1. Sta. 50, 2 ♂♂ 3·5 mm., 1 ♀ 3 mm. (♂=*promontorii*, ♀=*schizogeneios*). 2. Sta. 53, 1 ♀ 2·5 mm. (*schizogeneios*). 3. Sta. 64, 3 adult ♂♂ 4 mm. (*promontorii*). New Zealand : 4. Sta. 126, 1 ♂ 3·5 mm. (*promontorii*).

Remarks.—Chevreux and Stephensen, in contradistinction to Bovallius and Vosseler, adopt the view that *promontorii* is the ♂ of *schizogeneios*, but ignore the rule of priority by which, if their view is correct, the species should be known as *promontorii*, which has page precedence.

A re-examination of the " Challenger " material might help towards a solution of the question.

In the above occurrence I have indicated which specimens are *promontorii* (segments 1 and 2 fused) and which are *schizogeneios* (segments 1–3 fused), in case later researches should keep the two forms separate.

No. 4 constitutes the first record of this species outside the Atlantic Ocean.

Distribution.—Atlantic, about 40° N.–45° S. ; Pacific ?

Hyperia galba (Mont.).

G. O. Sars, 1895, p. 7, pl. 2, pl. 3, fig. 1 ; Walker, 1903, p. 40 (*gaudichaudii*) ; and 1904, p. 235 ; Barnard, 1916, p. 285 (*gaudichaudii*, literature); Stephensen, 1924, p. 81, chart 11; Spandl, 1927, p. 153 (*galba*), and p. 153, fig. 2 (*antarctica*).

Occurrence.—1. Sta. 38, Atlantic, South ; 1 ovig. ♀ 19 mm. 2. Sta. 161, Australia ; 8 ♂♂ (adult) 10–11 mm., 16 ♂♂ (penultimate instar) 8–10 mm., 1 ovig. ♀ 8 mm., 17 ♀♀ 10–17 mm., 30 juv. 4–8 mm.

Remarks.—There seem to be really no characters which can be relied upon to separate *gaudichaudii* from *galba*. From an examination of a few English (Plymouth) specimens, compared with the Cape specimens formerly recorded by me as *gaudichaudii*, and with the present specimens from Melbourne, I find that the 5th joint of peraeopod 1 is usually distinctly serrulate in the English specimens, but scarcely and indistinctly so in the southern specimens. The 6th joint is always serrulate. In gnathopods 1 and 2 the teeth on the lower margin of 6th joint are very frequently more or less

compound, i.e. subsidiary denticles are present at the bases of the larger teeth, in the southern specimens; so that a sharp and constant contrast between *galba* and *gaudichaudii*, as Bovallius suggested might be the case, does not exist.

Stephensen (1924, p. 82) is doubtful whether *spinigera* should be regarded as a synonym of *galba*. Tattersall maintains it as a valid species. I believe that the alleged differential characters are not constant or always real. Thus I find that the lower apical angle of 5th joint of gnathopod 1 often owes its rounded appearance (see Bovallius, 1889, pl. 10, fig. 34) to the degree of pressure exerted by the cover-slip when the limb is mounted for examination, and consequently also to the angle from which it is viewed. The resemblance between Bovallius' figure just quoted and Spandl's Fig. 2, *a*, of *antarctica* is noteworthy. I can also endorse Norman's statement (1900, Ann. Mag. Nat. Hist. ser. 7, vol. 5, p. 129) as to the gradual increase in spination of gnathopods 1 and 2 as the animal grows. On these grounds Norman makes *spinigera* a synonym of *galba*, and for the same reason and the above given explanation of the often variable appearance of the 5th joint of gnathopod 1, I have no hesitation in regarding *antarctica* also as a synonym.

In No. 2 of the present collection it is interesting to find an ovigerous ♀ only 8 mm. long amongst a lot of non-ovigerous ♀♀ of much larger size (cf. Stephensen, 1924, p. 83).

Ovigerous ♀♀ were found in October (Melbourne) and February (Falkland Is.). There appear to be no other records of actually ovigerous ♀♀ from the Southern Hemisphere. In the Northern Hemisphere Stephensen (p. 83) records them for the months of March, June, and particularly August and September.

Distribution.—Mediterranean; Arctic and Antarctic Seas; North Atlantic, southwards to 17° N. ("Gauss") and South Atlantic, northwards to about 26½° S. (Angra Pequena: Barnard); Indian Ocean, Ceylon (Walker) and 33° S. 33° E. (Stephensen); North Pacific.

Hyperia macronyx, Wlkr.

Walker, 1907, p. 7, pl. 1, fig. 1.

Occurrence.—Antarctic: 1. Sta. 289, 1 ♀ 10 mm. 2. Sta. 343, 2 ♀♀ 7·5 and 9 mm. 3. Sta. 354, 1 ♂ 9 mm., 1 ♀ 6·5 mm.

Remarks.—The following notes may be given as supplementing Walker's description. There is a tooth on all three pleon segments as stated, though the figure omits that on segment 2. The serration on 6th joint of gnathopods 1 and 2 in both sexes is strong and regular, the teeth simple. The hind margin of 5th and 6th joints in peraeopods 1 and 2 in ♀ is serrulate; in ♂ the margins in peraeopod 1 are better described as spinulose, and in peraeopod 2 as setulose. In peraeopod 3 the front margin of 5th joint in ♀ has only indications of serrulations (in No. 2 these serrulations are rather more distinct); the 6th joint is distinctly serrulate; in the ♂ both 5th and 6th joints are finely spinulose, not serrulate. In peraeopods 4 and 5 in ♀ the front margins of 5th and 6th joints are quite smooth (except for the widely spaced spinules);

in ♂ peraeopod 4 has 5th and 6th joints finely spinulose or setulose, but peraeopod 5 resembles that of ♀. The uropods are figured quite correctly.

This species, as Walker points out, bears a very close resemblance in certain features to *Parathemisto* ; but the dilated 5th joint of gnathopod 1 and the short peduncle of uropod 3 are features of *Hyperia.*

Distribution.—McMurdo Sound, Antarctic.

Gen. HYPERIELLA, Bov.

Stebbing, 1888, p. 1403 ; Bovallius, 1889, p. 241 (key to the 2 species) ; Spandl, 1927, p. 161 (key to the 2 species).

Hyperiella dilatata, Stebb.

Stebbing, 1888, p. 1403, pl. 171 (♀) ; Walker, 1903, p. 40, and 1907, p. 8 (juv.) ; Spandl, 1927, p. 162, fig. 5 (♂).

Occurrence.—Antarctic : 1. Sta. 267, 2 ♀♀ 4 and 5 mm. 2. Sta. 269, 2 ♀♀ 4 mm. 3. Sta. 281, 1 ♂ (penultimate instar) 5·5 mm. 4. Sta. 282, 1 ♀ 5 mm., 1 juv. 3·5 mm. 5. Sta. 284, 1 ♂ 5·5 mm., 7 ♀♀ 4·5–5·5 mm. 6. Sta. 285, 1 ♂ 5 mm., 1 ♀ 5·5 mm. 7. Sta. 289, 3 ♀♀ 5·5 mm. 8. Sta. 290, 2 ♀♀ 5·5 mm. 9. Sta. 326. 17.vi.11. 18 metres. 1 ♂ 6 mm., 4 ♀♀ 5 mm., 2 juv. 4 mm. 10. Sta. 326. 3.xii.11. 10 metres. 1 ♂ (penultimate instar) 5 mm., 22 ♀♀ 5–6 mm. 11. Sta. 326. 28.vi.11. 20 metres. 6 ♂♂ 5·5–6 mm , 1 ♂ (penultimate instar) 5·5 mm., 7 ♀♀ 5–5·5 mm., a lot juv. 3·5–4·5 mm. 12. Sta. 326. 8.viii.11. 10 metres. 3 ♂♂ 6 mm., 2 ♂♂ (penultimate instar) 5–5·5 mm., 3 ♀♀ 5 mm., 46 juv. 2·5–4·5 mm. 13. Sta. 326. 18.v.12. 10 metres. 1 ♂ 6·5 mm., 4 ♀♀ 5–6·5 mm. 14. Sta. 342, 3 ♂♂ 5 mm., 5 ♀♀ 5 mm. 15. Sta. 350, 1 ♀ 4 mm.

Remarks.—The present specimens agree with Stebbing's excellent figures of the ♀, and on the whole with Spandl's figures of the ♂.

I find, however, that peraeopods 3–5 in the ♂ have the 5th and 6th joints with very distinct serrulation or spinulation along front margins, and front apical angles of 4th joint (especially in peraeopod 5) are stronger.

Also, I doubt whether Spandl's Fig. 5, *h*, of the uropods was drawn from a fully adult ♂ ; at any rate the present specimens, including the penultimate instar, show the inner ramus of uropod 3 slightly though distinctly broader than in the ♀. The outer margins of outer rami of all the uropods may have a minute spinule or two, but are not serrate like the other margins.

In the young (3 mm.) only the 6th joint of peraeopod 3 is spinulose, the 5th joint of peraeopod 3 and the 5th and 6th joints of peraeopods 4 and 5 smooth. The points on 2nd–4th joints of peraeopods 3–5 are not developed ; and likewise the points on pleon segments 1–3 are not so prominent.

Spandl, when claiming that this species had not been found since the " Challenger " Expedition until the " Gauss " captured it, overlooks Walker's record of the young specimens taken by the " Discovery " (1901–1904).

This is a more antarctic species than *antarctica*, only one of the "Gauss" records transgressing slightly the 60th parallel into lower latitudes (58° 29′ S.).

All stages, juv. to adult ♂♂ and ♀♀, were found in June, August and January; adults in March, May, and December; Walker records young in November to July. Apparently it breeds all the year round, though it is remarkable that the "Terra Nova" collection contains not a single actually ovigerous ♀. Spandl gives no biological details of the "Gauss" specimens.

Distribution.—Antarctic: 63° S. 88° E. (Stebbing), McMurdo Sound (Walker), 58°–66° S. 85°–89° E. (Spandl).

Hyperiella antarctica, Bov.

Bovallius, 1889, p. 242, pl. 11, figs. 42–51; Stewart, 1913, p. 256.

Occurrence.—New Zealand: 1. Sta. 248, 1 ♀ 5·5 mm. 2. Sta. 250, 3 ♂♂ 5–6 mm.

Remarks.—Miss Stewart has already remarked on the presence in the "Discovery" (1901–1904) specimens of points on pleon segments 1–3. The same is the case with the present specimens. In the ♀ pleon segment 3 appears quite rounded, but pleon segments 1 and 2, and all three segments in the ♂, possess points, which, it is true, are not so prominent and sharp as in *dilatata*.

Moreover the points on the distal front angles of 2nd–4th joints in peraeopods 3–5 are here present, though they also are not so strongly developed as in *dilatata*, especially on the 4th joints. It should be noted that these points are more obvious when the limb is straight than when it is flexed. But they have not the slight outward (forward) curvature so characteristic of *dilatata* (cf. the young of *dilatata*).

The sharp distinction between the two species lies in the uropods. The inner rami of uropods 2 and 3 in the ♀ *antarctica* (not described or figured by Bovallius) are lanceolate and very similar to those of the *male of dilatata*, though a little broader; and those of the ♂ are still broader and more ovate, as figured by Bovallius.

These specimens were caught quite close to the locality whence Miss Stewart reported the species. The only other record is that of Bovallius. The species, so far as we yet know, does not inhabit latitudes higher than 60° S.

Distribution.—Off Cape Horn (58° 43′ S. 76° W.) (Bovallius); 56° 30′ S. 169° 30′ E. (Stewart).

Gen. HYPERIOIDES, Chevr.

Chevreux, 1900, p. 143; Vosseler, 1901, p. 56 (*Parahyperia*); Stebbing, 1904, p. 34.

Hyperioides longipes, Chevr.

Chevreux, 1900, p. 143, pl. 17, fig. 2; Vosseler, 1901, p. 60, pl. 7, figs. 6–20 (*sibaginis* (non Stebb.) var. *longipes*); Walker, 1903, p. 229, pl. 19, figs. 7–13; Stebbing, 1904, p. 35; Chevreux, 1913 a, p. 6; Stewart, 1913, p. 256; Stephensen, 1924, p. 93; Chevreux and Fage, 1925, p. 407, fig. 405; Spandl, 1927, p. 164.

Occurrence.—New Zealand: 1. Sta. 80, 1 ♂ 3·5 mm., 1 ♀ 3 mm. 2. Sta. 85, 3 ♂♂

(adult) 3·5–4 mm., 1 ♂ (penultimate instar) 3 mm., 4 ♀♀ 3 mm. 3. Sta. 86, 2 ♂♂ (adult) 4 mm., 3 ♂♂ (penultimate instar) 3·5 mm., 4 ♀♀ 3–3·5 mm., 2 juv. 2·5 mm. 4. Sta. 93, 14 ♂♂ 4 mm., 18 ♀♀ 3·5 mm. 5. Sta. 127, 1 ♀ 3·5 mm. 6. Sta. 240, 1 ♀ 6 mm.

Remarks.—These specimens were at first thought to be *Hyperia sibaginis*, Stebb., a species which, being recorded from the Philippine Islands and China Sea, might well be expected to occur off the north of New Zealand. They prove, however, to be *H. longipes*, which hitherto has not been known from the Pacific. No. 6 from south of New Zealand is the most southerly locality yet recorded ; and the size of the specimen is notably greater than that of the others from lower latitudes.

The shape of the head, disposition of the ocelli, comparative narrowness of the 2nd joints of peraeopods 3–5, and other features, are all in accordance with the descriptions and figures of *longipes*.

It is curious that no previous author has drawn attention to the remarkable similarity of the uropods of *H. sibaginis* and the present form. The notching of the outer margins of the outer rami of all three pairs of uropods alone distinguishes *sibaginis* from the other species of *Hyperia ;* and the uropods of *sibaginis* and *longipes* are indistinguishable. With due respect to Stebbing's opinion (1904, p. 35), a re-examination of the " Challenger " specimen might prove interesting.

Distribution.—Mediterranean ; Atlantic, 51° N–37½° S.

Gen. HYPEROCHE, Bov.

Bovallius, 1889, p. 83 ; Senna, 1908, p. 154.

Members of this genus appear to be distinctly rare in comparison with other Hyperiids. There are only one male and a damaged juvenile in the present collection. For the former it seems necessary to propose a new specific name ; though represented by only one specimen here, a second specimen had fortunately been recorded and figured, a fact which helps to substantiate the validity of the species.

The species of this genus may be distinguished thus :

1. Pleon segments 1–3 with small points posteriorly.
   - *a.* Front apical angle of 6th joint of gnathopods 1 and 2 not produced.
     - i. Hind margin of 5th and 6th joints of peraeopods 1 and 2 serrate .. .. *medusarum* (Kröy) (syn. *kroeyeri, tauriformis, prehensilis, abyssorum, luetkeni*)
     - ii. Hind margin of 5th and 6th joints of peraeopods 1 and 2 not serrate .. .. *luetkenides*, Wlkr.
   - *b.* Front apical angle of 6th joint of gnathopods 1 and 2 produced.
     - i. 4th joint of gnathopods 1 and 2 not produced .. *picta*, Bov.
     - ii. 4th joint produced .. .. *capucinus*, n. sp.
2. Pleon segments 1–3 rounded posteriorly.
   - *a.* 4th joint of gnathopods 1 and 2 not produced .. .. *martinezii*, Müll.
   - *b.* 4th joint produced .. .. *mediterranea*, Senna.

I have purposely omitted *cryptodactylus*, Stebb., from the above key, as I am very doubtful whether the cryptodactyle appearance is really normal, especially in view of the condition of the juvenile specimen in the present collection noted below (p. 417).

Hyperoche capucinus, n. sp. (Fig. 54.)

Monod, 1926, p. 49, figs. 47, 48 (*luetkenides*, non Walker).

Occurrence.—Sta. 224, Antarctic; 1 ♂ 14 mm.

Description.—Monod has figured the characteristics of this species without, however, specially referring to the chief ones, namely: the shape of the 6th joint of the first two gnathopods, especially that of gnathopod 1. Characters of the present specimen as follows.

Postero-inferior angles of pleon segments 1–3 pointed. Telson triangular, sides

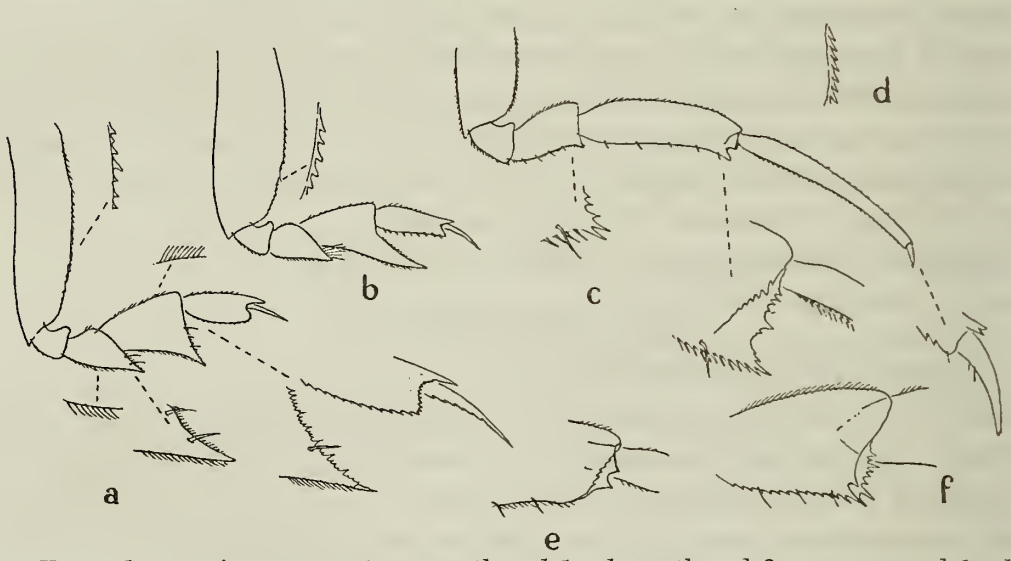

Fig. 54.—*Hyperoche capucinus*, n. sp. ♂. *a*, gnathopod 1; *b*, gnathopod 2; *c*, peraeopod 1; *d*, front margin of 2nd joint of peraeopod 2; *e*, junction of 5th and 6th joints of peraeopod 3; *f*, junction of 4th and 5th joints of peraeopod 5.

straight or slightly concave, apex subacute, not quite equal to half length of peduncle of uropod 3. Third joint of mandibular palp not quite as long as 1st and 2nd joints together. First joint of flagellum of antenna 1 without brush of setae; flagella of both antennae about 6 mm. in length, composed of 23–24 joints.

Gnathopods 1 and 2: 2nd joint with minute denticles and spinules on front margin, 3rd joint normal (i.e. the "reduced" appearance in Monod's figure seems to be due to the flexure of the limb), 4th joint apically produced, lower (hind) margins of 3rd–5th, and upper (front) margins of 4th–6th joints minutely setulose, 6th joint acutely produced at front apical angle; in gnathopod 1 6th joint is ovate-oblong, nearly the same width throughout, and not tapering distally to nearly the same width as base of dactylus; in gnathopod 2 6th joint is more slender, but apically distinctly wider than width of dactylus, its lower distal angle subacute (rounded in Monod's figure).

Peraeopods 1 and 2 : front margin of 2nd joint in peraeopod 1 setulose, becoming serrulate distally, in peraeopod 2 serrulate throughout ; front margins of 3rd–6th joints minutely setulose, hind margins of 2nd–4th joints setulose, the 4th joint with a few larger spinules ; lower apices of 3rd and 4th joints ending in 2–3 spines, 5th joint certainly longer proportionately to 4th than in *medusarum* (Bovallius' and Sars' figures), its lower margin spinulose, more strongly so in 1st than in 2nd peraeopod, with a few longer spinules, lower distal angle acute in peraeopod 1, spinose, distal margin spinose, in peraeopod 2 distal angle obtusely angular, spinulose ; 6th joint with very regular pectination on lower margin, front apical angle with 2 rather stout spines overlapping base of dactylus.

Peraeopods 3 and 4 : front margin of 2nd–6th joints and hind margin of 3rd–6th joints minutely setulose, hind margin of 2nd joint minutely denticulate ; 4th and 5th joints with 2–3 points on distal margin. Peraeopod 5 similar to peraeopods 3 and 4, but front margin of 3rd and 4th joints spinulose more than setulose, and distal margin of 4th joint with several unequal points and denticles. Peraeopods 3–5 are about as long as peraeopods 1 and 2.

Uropods : both margins of peduncle of uropod 1, and outer margin of peduncles of uropods 2 and 3 minutely setulose ; inner margin of peduncles of uropods 1 and 2 serrulate, and distal (transverse) margins of all peduncles denticulate ; margins of all rami serrulate, except outer margin of outer ramus of all three uropods, though outer margin of outer ramus of uropod 1 is slightly serrulate distally.

Remarks.—Many of the above details will probably be found to be common to other species of the genus, but up to the present none of the published figures, not even those of Sars and Bovallius, indicate more than the major details, like the serration on the 5th and 6th joints of gnathopods 1 and 2. Monod's figure 47, A, of the uropods does not give a hint of the serrations along the margins which surely must exist, judging by analogy with other species ; at least it would be highly remarkable if they were absent.

The main diagnostic features of this species are : the shape of the 6th joint of gnathopods 1 and 2 (especially gnathopod 1) and the sharp projection over the base of the dactylus ; the relative length of the 5th joint in peraeopods 1 and 2, and the sharply triangular telson.

Distribution.—70° 33′ S., 89° 22′ W. (" Belgica ").

Hyperoche, sp.

Occurrence.—Sta. 139, New Zealand ; 1 juv. ♂ 4 mm.

Remarks.—The specimen is too damaged to be identified with certainty, but is interesting for the following reason. The specimen is preparing to moult ; the dactyli of gnathopods 1 and 2 have been torn off, and the dactyli of the new skin forming within project a little way through the openings so formed. The appearance is very similar to that figured by Stebbing for *cryptodactylus* (1888, pl. 170, gn. 2).

Gen. IULOPIS, Bov.

Bovallius, 1887, Bih. K. Sv. Ak. Handl. xvi. No. 16, p. 17 ; Bovallius, 1889, p. 116 (*Euiulopis*, altered to avoid confusion with *Iulopsis*, Heer, 1874) (key to species) ; Senna, 1908, p. 173 (*Euiulopis*) ; Stephensen, 1924, p. 80 (*Euiulopis*) ; Spandl, 1927, p. 159 (*Euiulopis*) (key to species).

Apart from the derivation of the two names *Iulopis* and *Iulopsis* and the fact that there is not likely to be any confusion between the living Hyperiid and a fossil Myriopod, Bovallius should not have proposed, and later authors accepted, any alteration of his original name. *Iulopis* is a perfectly valid name and must stand.

Iulopis loveni, Bov.

Bovallius, 1889, p. 118, pl. 8, figs. 1–18 ; Senna, 1908, p. 173, pl. 1, fig. 3 (coloured fig. juv. ♂) ; Stephensen, 1924, p. 80, chart 11 ; Spandl, 1927, p. 159, fig. 4 (*Euiulopis* sp. and *loveni*).

Occurrence.—New Zealand : 1. Sta. 86, 1 ♂ 4·5 mm., 1 ♀ (with uterine ova) 5·5 mm. 2. Sta. 89, 1 ♀ 3 mm. 3. Sta. 93, 1 ♂ 4·5 mm. 4. Sta. 103, 1 ♂ (penultimate instar) 5 mm., 1 ♀ 3 mm. 5. Sta. 107, 6 ♂♂ 5·5–6 mm. 6. Sta. 109, 1 ♂ 6 mm. 7. Sta. 110, 6 ♂♂ 4·5–6 mm. 8. Sta. 118, 3 ♂♂ 5–6 mm. 9. Sta. 130, 1 ♂ (penultimate instar) 4 mm. 10. Sta. 139, 2 ♂♂ 4·5–5 mm.

Remarks.—There are 20 fully adult ♂♂, 2 in the penultimate instar, and only 2 ♀♀, one of which is not fully grown and the other has uterine ova. Stephensen (1924, p. 80) obtained ♂♂ and ♀♀ in the proportion of about 3 : 5.

The telson in ♀ is more rounded than in ♂, and the margin is densely hairy ; the latter feature is contrary to Bovallius' statement. In both sexes, in addition to the spinulation of the margins of the rami of uropod 3 mentioned by Bovallius, there is a similar minute spinulation of the inner margin of outer ramus and outer margin of inner ramus in uropods 1 and 2.

The characteristic apical spine on the 5th joint of gnathopods 1 and 2 is sometimes small or absent ; thus it is small in one specimen each of Nos. 5 and 7, absent from gnathopod 2 on one side in one specimen of No. 8, and absent altogether from both gnathopods in No. 4 (♂). The spines are present in both ♀ specimens.

The 6th joint of peraeopods 3–5 is not apically dilated in ♀, as described and figured by Bovallius, and does not differ in the two sexes. Possibly this is a feature which is only developed at the last moult when the eggs are shed into the brood pouch.

None of the specimens has the peculiar apical form of the outer ramus of uropod 2 found in Spandl's juvenile specimen.

The discovery of this species in the Pacific is most interesting. One would have expected *mirabilis*, which is recorded from the Bay of Panama (Bovallius), rather than *loveni* to be found in the New Zealand area. None of the specimens exhibits features approximating in the least to those of *mirabilis*.

Distribution.—Mediterranean ; Tropical Atlantic (17° N.).

Gen. PARATHEMISTO, Boeck.

See : Stebbing, 1888, p. 1407 (*Euthemisto*) and p. 1419 ; Bovallius, 1889, p. 248 (key to species) and p. 275 (*Euthemisto :* key to species) ; Stephensen, 1923, p. 19 (*Themisto :* key to European species), and 1924, p. 95 (*Themisto*) ; Mogk, 1926, p. 65 (*Themisto :* analysis of *compressa-bispinosa* differences).

If *Parathemisto* and *Euthemisto* are to be united, as seems reasonable in the light of recent researches, then Boeck's name must be used as having priority, *Themisto* dropping out as being twice preoccupied (Oken, 1807 and again 1815, Mollusca).

In spite of Stephensen's and Mogk's work, it is evident that a further analysis of considerably more material would not be amiss, especially as regards the growth stages. Mogk's Fig. 46 (p. 85) is illuminating and suggestive.

Chevreux and Fage (1925) differentiate the two genera by the relative lengths of the ♀ antennae and the 3rd–5th peraeopods ; but these characters would seem to have at most only specific value.

As regards the synonymy of the species of the genus reference may be made to the austral representatives. What is the real position of *E. australis*, Stebb., 1888 ? Stephensen (1924, p. 106) says it is uncertain. Bovallius (1889, p. 298) says that Stebbing has omitted important details ; in his key (p. 280), however, he incorporates one of the features to which Stebbing (p. 1419) specially drew attention, viz. the pectination of the inner * margin of the inner ramus of uropod 3.

This is a feature which is only found elsewhere in *abyssorum* and *gracilipes* (see Stephensen, 1924, pp. 96 and 99, figs. 36, 38 and 39, 40, 41) and in *japonica* (see Bovallius, p. 262, pl. 12, fig. 43), with which latter *pacifica*, Stebb. (1888, p. 1422), is doubtless synonymous. In *abyssorum* the 1st antenna is nearly straight and equal to the 2nd antenna (*Parathemisto*, s. str.), but Stebbing's specimen was a ♂, so other features must be examined for comparison. Stebbing also specially refers to the hairiness of the lower margins of the 4th and 5th joints in peraeopod 3–6, and also the shape of the 5th joint in peraeopod 3. Stephensen describes and figures these features for the ♂ *gracilipes*, and considers the shape of the 5th joint of peraeopod 3 as very characteristic.

I would suggest, therefore, that *australis* is the southern representative of the northern form known as *gracilipes* (Stebbing advocates dropping Kröyer's name *oblivia* on the score of uncertainty, 1888, p. 1419) ; but, for the reason given below, I would keep them as separate species.

There is considerable difficulty in separating *gracilipes* from both forms of *gaudichaudii*, especially f. *compressa* (Stephensen, 1924, p. 98), and Mogk (1926, pp. 69, 70) criticises the key given by Stephensen (1923, p. 19) in respect to these two species. It may be that the pectination of the inner ramus of uropod 3 will be found to be a constant differential character, and, while fully realising that the last word has not,

* Inner is here used in the normal sense to mean the margin nearest the central axis of the whole animal, not as used by Stephensen (1924, p. 99, 109), the axis of the uropod itself.

by a long way, been spoken on the "Euthemisto" question, the following tentative conspectus of the species may be given :—

I. Ant. 1, ♀ slender, straight, extending about as far as ant. 2. Prp. 3, 4, 5 subequal. Peduncle urop. 3 strongly produced at inner distal angle	s.g. *Parathemisto* (s. str.)
Inner ramus urop. 3 pectinate on both margins	*abyssorum* (syn. *oblivia*, Sars, Chevr. and Fage, non Kröyer) *japonica* (syn. *pacifica*)
II. Ant. 1, ♀ stouter, hooked, extending distinctly less far than ant. 2. Prp. 3 more or less longer than prp. 4 and 5. Ped. urop. 3 less strongly produced at inner distal angle	s.g. *Euthemisto*
A. Inner ramus urop. 3, pectinate on both margins.	
1. Inner margin peduncle urop. 3 smooth throughout	*gracilipes* (=*oblivia*, Kröyer, non Sars, non Chevr. and Fage)
2. Inner margin ped. urop. 3 distally serrulate ..	*australis*
B. Inner ramus urop. 3 pectinate only on outer margin.	
1. 2nd joint prp. 4, 5, broad	*libellula*
2. 2nd joint prp. 4, 5, narrow	*gaudichaudii* f. *compressa* and *bispinosa*

P. goesi, Bov., *trigona*, Dana, and *batei*, Bov., are in all probability young *gaudichaudii*; on *P. rubescens*, Dana, I express no opinion.

Parathemisto (*Euthemisto*) *gaudichaudii* (Guer.).

Bovallius, 1889, p. 2999, text-figs. 1–5, pl. 13, figs. 44–46 ; Walker, 1907, p. 9 ; Barnard, 1925, p. 374 ; Chilton, 1926 (Tr. N.Z. Inst. lvi.), p. 512.

Occurrence.—Antarctic : 1. Sta. 167, 6 juv. 4–5 mm. 2. Sta. 217, 1 juv. 8 mm. 3. Sta. 229, 3 ♀♀ 12–14 mm. 4. Sta. 230, 22 ♀♀ 13–15 mm. New Zealand : 5. Sta. 235, a lot juv. 2·5–4·5 mm. 6. Sta. 237, 5 ♀♀ 12–17 mm. 7. Sta. 238, 2 ♀♀ 14 and 16 mm., numerous juv. 2–4 mm. 8. Sta. 240, 43 juv. 2–4 mm. 9. Sta. 250, a lot juv. and ♀♀ 4–9 mm. 10. Sta. 251, a lot juv. and ♀♀ 4–9 mm. 11. Sta. 252, 4 juv. 5·5–7·5 mm. 12. Sta. 256, 40 juv. 2·5–4 mm. Antarctic : 13. Sta. 264, 4 juv. 3–7 mm. New Zealand : 14. Sta. 302, 22 juv. 2–4 mm. 15. Sta. 304, 5 juv. 4–8 mm. 16. Sta. 306, 2 ♀♀ 10–11 mm., 10 juv. 3–6 mm. Atlantic, South : 17. Sta. 308, 1 juv. 5·5 mm. 18. Sta. off Campbell Islands. 28.iii.12. Plankton, night. 14 ♀♀ 13–17 mm.

Remarks.—There are comparatively few large ♀♀ and not a single ♂ in the collection. In the Southern Atlantic (according to the collection of the "Discovery," 1925–1927, which I am now studying) breeding appears to take place about November to February, or even earlier (October). It seems probable, therefore, that the "Terra Nova" collecting in December was not quite early enough in the southern spring to catch adults.

The distribution is extended still further into the Ross Sea, as far as $66\frac{3}{4}^\circ$ S. (No. 2). The most northerly locality is No. 15 in $48\frac{1}{2}^\circ$ S.

Distribution.—Southern Atlantic, Indian and Pacific Oceans ; Antarctic.

Parathemisto (*Euthemisto*) *gracilipes* (Norman).

Stephensen, 1924, p. 97, figs. 39–42 (literature and synonymy); ? Stewart, 1913, p. 257 (as *oblivia*, Kröy.).

Occurrence.—Sta. 1, 1 ♀ 6 mm. (with ova ready to be shed into brood pouch).

Distribution.—Mediterranean; North Atlantic (about 55°–39° N.); ? South Atlantic, 15° S. (Stewart).

Parathemisto (*Euthemisto*) *australis* (Stebb.). (Fig. 55.)

Stebbing, 1888, p. 1417.

Occurrence.—New Zealand: 1. Sta. 109, 1 ♀ 6 mm. 2. Sta. 110, 5 ♂♂ 6·5–7 mm., 1 ♀ 7 mm. 3. Sta. 126, 1 ovig. ♀ 6·5 mm. 4. Sta. 139, 4 ♀♀ 5–6·5 mm. 5. Sta. 142, 1 ♀ 7·5 mm. Australia: 6. Sta. 161, 1 ♂ (penultimate instar) 6·5 mm.

Remarks.—The serration or pectination of the rami of all the uropods very strong.

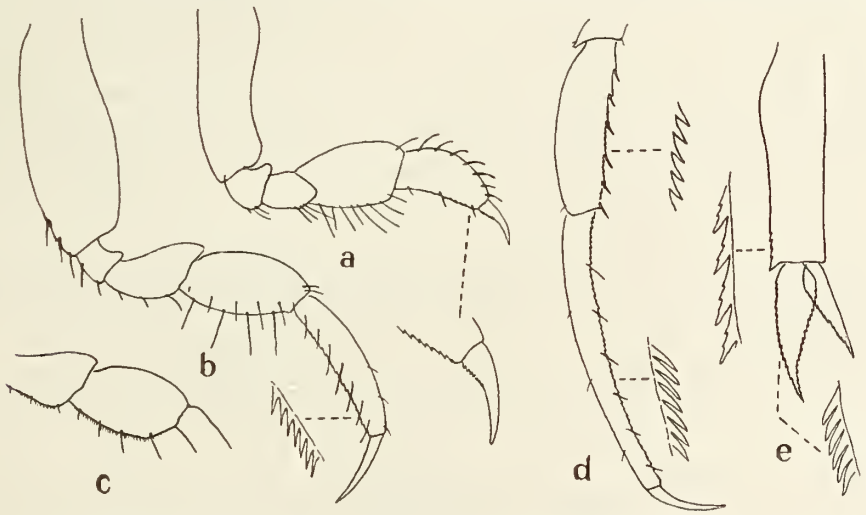

Fig. 55.—*Parathemisto* (*Euthemisto*) *australis* (Stebb.). *a*, gnathopod 1 ♀; *b*, peraeopod 1 ♀; *c*, 4th and 5th joints of peraeopod 1 ♂; *d*, peraeopod 3 ♀; *e*, uropod 3 ♀.

The lower margins of pleon segments 1–3 are scarcely serrulate, as Stebbing describes them; there are, however, a few very minute spinules each in a slight indent. This feature may be regarded as a variable one (cf. *Cyllopus*) and of no specific importance. The hairiness of the 4th and 5th joints (Stebbing, 3rd and 4th) in peraeopods 1–4 is very feebly developed in the present ♂♂, and is quite absent in the ♀ (as in the ♀ of *gracilipes*). The 3rd uropod as described by Stebbing, but with the additional feature in both sexes of having the inner margin of the peduncle serrulate distally; the serrulation is stronger in the ♂ than in the ♀, but is not always easily seen.

This seems to be a southern form corresponding with the northern *gracilipes;* but the serration on the 3rd uropod is sufficient reason for keeping *australis* separate, as this feature is not mentioned by Stephensen, and is not present in the single ♀ specimen of *gracilipes* collected by the "Terra Nova."

Distribution.—S.W. of Melbourne (39° 45′ S., 140° 40′ E.) and Bass Strait.

Family PHRONIMIDAE.

Gen. PHRONIMA, Latr.

Vosseler, 1901, p. 1 ; Stephensen, 1924, p. 113 (key to species) ; Mogk, 1926, pp. 160 *sqq.* and 1927, p. 127.

Phronima sedentaria (Forsk.).

Vosseler, 1901, p. 14, pl. 1, figs. 1–11. Hutton, 1904, p. 246 (*novae-zealandiae*) ; Stephensen, 1924, p. 114, figs. 50, 51, chart 15. Mogk, 1927, p. 127, chart 1.

Occurrence.—1. Sta. 46, Atlantic, North ; 1 ♀ 9 mm. New Zealand : 2. Sta. 80, 1 juv. ♂ 5 mm. (6th instar). 3. Sta. 106, 1 juv. ♀ 7 mm. 4. Sta. 235, 6 ♂♂ 5–10 mm. (6th and 7th instars), 4 ♀♀ 6–11 mm., 1 ♀ 16 mm. 5. Sta. 238, 1 juv. ♂ 7 mm., 1 juv. ♀ 6 mm. 6. Off Campbell Islands. 26.iii.12. 5 fathoms, night. 2 ♀♀ 27 and 30 mm., in houses with juv. in 4th and 5th instars. 7. Off Campbell Islands. 28.iii.12. Plankton, night. 3 ♀♀ 10–11 mm. 8. Sta. ? (label : " ? Winter Cruise "), 1 ♀ 16 mm.

Remarks.—Mogk (1927, p. 130) states that the young up to and including the 4th instar remain in the house ; in the case of No. 6 above there are both 4th and 5th instars, and according to the label all the young were within the houses at the time of capture.

This species was hitherto known from 50° S. in the Pacific, so that the catches from Sta. 235, 238, and off the Campbell Islands extend slightly the southernmost limit in this ocean.

Distribution.—Mediterranean ; Atlantic, Indian, and Pacific Oceans.

Phronima atlantica, Guer.

Vosseler, 1901, p. 21, pl. 2, figs. 1–10 ; Stephensen, 1924, p. 121, chart 16 ; Mogk, 1927, p. 131, chart 2.

Occurrence.—1. Sta. 66, Atlantic, North ; 5 adult ♂♂ 5·5–7 mm., 1 ♀ 6 mm., 1 ♀ 8 mm. New Zealand : 2. Sta. 83, 1 ♀ 7 mm. 3. Sta. 84, 1 ♂ 7 mm. (7th instar). 4. Sta. 86, 2 juv. ♂♂ 6–7 mm. (6th and 7th instars), 3 juv. ♀♀ 4–8 mm. 5. Sta. 92, 2 adult ♂♂ 7·5–8 mm., 3 ♂♂ (penultimate instar), 6–7·5 mm., 3 ♀♀ 6 mm., 1 ♀ 14 mm. 6. Sta. 93, 5 ♂♂, 7 ♀♀ (in poor condition). 7. Sta. 112, 1 ♂ 7 mm. (7th instar). 8. Sta. 126, 1 ♂ 7 mm. (7th instar). 9. Sta. 127, 2 ♂♂ 6 and 7 mm. (6th and 7th instars), 1 ♀ 11 mm. 10. Sta. 130, 3 ♂♂ 8 mm. (1 in 7th, 2 in 8th instar), 1 ♀ 14 mm. 11. Sta. 139, 1 ♀ 11 mm. 12. Sta. 143, 1 ♂ 6 mm. (7th instar). 13. Sta. 236, 1 ♂ 8 mm. (6th instar), 1 ♂ 10·5 mm. (7th instar).

Remarks.—The species is already known from the Antarctic (" Gauss ") and the South Pacific to 30° S. It is new to the area north of New Zealand, and its southern limit is extended to 52° S. 167° E. The larger size of the specimens from this latter locality (No. 13) in comparison with those from lower latitudes is noticeable.

Distribution.—Mediterranean ; Atlantic, Indian, Pacific, and Antarctic Oceans.

Phronima atlantica, var. *solitaria*, Guer.

Vosseler, 1901, p. 23, pl. 2, fig. 5 ; Stephensen, 1924, p. 125 ; Mogk, 1927, p. 133, chart 3.

Occurrence.—Sta. 59, Atlantic, North ; 1 ♀ 14 mm.

Distribution.—Similar to that of the typical form, but excluding the South Atlantic and Antarctic.

Phronima pacifica, Streets.

Vosseler, 1901, p. 29, pl. 3, figs. 4–7 ; Stephensen, 1924, p. 130 ; Mogk, 1927, p. 140, chart 8.

Occurrence.—1. Sta. 50, Atlantic, North ; 1 ♂ 4 mm., 1 ♀ 4 mm., 1 ♀ 7 mm. 2. Sta. 61, Atlantic, North, 1 ♀ 4 mm.

Remarks.—The ♂ corresponds with the 6th instar of *atlantica*. It agrees with Vosseler's description and figure of *colletti*, but as it was found together with ♀♀ which are undoubtedly *pacifica*, it is only reasonable to refer it to the latter species. The shape of the 4th and 5th joints of peraeopod 3 of the ♂ and the young ♀ are nearly identical ; the whole limb is not much shorter than peraeopod 2, as in the larger ♀.

Vosseler, Stephensen, and Mogk record both *pacifica* and *colletti* from the same haul on several occasions. All adult ♂♂ seem to refer to *colletti*, and the ♂ of *pacifica* is said to be not known with certainty. Stephensen (1924) records 541 ♂♂ and more than 1500 ♀♀ of *colletti* as against only 4 ♀♀ *pacifica ;* and from other records (see Stephensen) it would appear that *pacifica* is a much rarer form than *colletti*. Vosseler (1901, p. 35) had 3 ♂♂ which he was uncertain how to classify, remarking (p. 36) that if they were referred to *pacifica* the near relationship of the two species would be increased. Mogk also found specimens which were transitional in some respects (1927, p. 125). More research is evidently required, but it certainly seems not impossible that the ♀♀ may be dimorphic forms of one species (*pacifica*), though the *colletti* form is the more abundant and normal (cf. *P. atlantica* and var. *solitaria*, no ♂♂ of the latter variety being known).

The most southerly previous record for the Atlantic was about 9° S. (" Gauss ") ; the present Sta. 50 is at nearly 19° S.

Distribution.—Mediterranean ; Atlantic, Indian, and Pacific Oceans.

Gen. PHRONIMELLA, Claus.

Phronimella elongata, Claus.

Vosseler, 1901, p. 40, text-fig. ; Stephensen, 1924, p. 130, chart 19 ; Mogk, 1927, p. 141, charts 9–11.

Occurrence.—Atlantic, North : 1. Sta. 61, 1 juv. ♂ 4 mm., 3 ♀♀ 6–6·5 mm., 2 ♀♀ 10 mm., 1 ♀ 13 mm. 2. Sta. 66, 1 ♀ 10 mm. 3. Sta. 68, 3 ♂♂ 8–9 mm. 1 ♂ 8 mm. (penultimate instar), 1 ♀ 5·5 mm., 1 ♀ 7 mm. New Zealand : 4. Sta. 86, 2 ♂♂ 6–6·5 mm., 3 ♀♀ 10–13 mm. 5. Sta. 92, 1 ♀ 10 mm., 1 ♀ 14 mm. 6. Sta. 103, 1 ♀

14 mm. 7. Sta. 109, 1 ♂ 8 mm., 1 ♀ 8·5 mm. 8. Sta. 120, 2 ♀♀ 10–11 mm. 9. Sta. 127, 1 ♂ (head and peraeon only). 10. Sta. 311, Atlantic, South ; 1 ♂ 8·5 mm.

Remarks.—The species is new to the area to the north of New Zealand.

Distribution.—Mediterranean ; Atlantic, Indian, Pacific, and Antarctic Oceans.

Family PHROSINIDAE.

Stebbing, 1888, p. 1423 ; Bovallius, 1889, p. 396 (key to genera) (*Anchylomeridae*) ; Spandl, 1927, p. 167 (key to genera) (*Anchylomeridae*).

Gen. PHROSINA, Risso.

Stebbing, 1888, p. 1424 ; Bovallius, 1889, p. 421.

Phrosina semilunata, Risso.

Bovallius, 1889, p. 426, pl. 18, figs. 3–30 ; Vosseler, 1901, p. 89, pl. 8, figs. 18–20 ; Stephensen, 1924, p. 138, chart 21 ; Chevreux and Fage, 1925, p. 413, fig. 409 ; Spandl, 1927, p. 168, and p. 282, figs. 60, 61.

Occurrence.—1. Sta. 67, Atlantic, North, 1 ♀ 4·5 mm. New Zealand : 2. Sta. 85, 2 ♂♂ (adult) 6·5 mm., 1 ♀ 4 mm. 3. Sta. 86, 2 ♂♂ (antepenultimate and penultimate instars) 3 and 5 mm. 4. Sta. 92, 1 ♂ (penultimate instar) 5 mm. 5. Sta. 93, 2 juv. ♂♂ 3 mm., 25 ♂♂ (penultimate instar) 4–5 mm., 10 ♂♂ (adult) 7 mm. 6. Sta. 112, 1 ♂ (penultimate instar) 5 mm. 7. Sta. 120, 2 ♂♂ (adult) 6·5–7 mm., 3 ♂♂ (penultimate instar) 5–5·5 mm., 2 ♀♀ 5 mm. 8. Sta. 131, 1 ♂ (penultimate instar) 5 mm., 2 ♀♀ 6 and 7 mm.

Remarks.—Vosseler correctly states (p. 90) that the spinous projection on the basal joint of 1st antenna ♂ disappears in the fully mature animal, but does not state that in such animals the 1st joint of the flagellum has the lower inner apex produced, as in *Primno macropa*, a figure of which he gives (pl. 8, fig. 21). I doubt whether Vosseler's interpretation of the spines on the basal joint of 1st antenna as being the homologues of the frontal spines of the ♀ is correct. The smallest ♂ (3 mm.) resembles Vosseler's fig. 20, but the articulation with the head is more distinct. Moreover the fully adult ♂ has a pair of short blunt knobs obviously corresponding with the spine-like processes of the ♀.

Distribution.—Mediterranean ; Atlantic, 47° N.–35° S. ; Indian Ocean to 40° S. Pacific ; Antarctic, 64°–65° S., 80°–85° E. ("Gauss").

Gen. PRIMNO, Guer.

Stebbing, 1904, p. 38.

Primno macropa, Guer.

Vosseler, 1901, p. 87, pl. 8, fig. 21 (1st antenna adult) (*Euprimno macropus*) ; Stebbing, 1904, p. 38, figs. 1, 2 (juv. uropods) ; Stephensen, 1924, p. 143, chart 22 (*E. macropus*) ; Chevreux and Fage, 1925, p. 416, fig. 411 (*E. macropus*) ; Monod, 1926, p. 50, fig. 49 ; Spandl, 1927, p. 168, and 284, fig. 62.

Occurrence.—New Zealand: 1. Sta. 93, 1 ♂ (penultimate instar) 5·5 mm., 3 ♀♀ 6 mm. 2. Sta. 120, 2 ♂♂ (penultimate instar) 5·5 mm. 3. Sta. 130, 1 ♂ (penultimate instar) 6·5 mm. 4. Sta. 230, 1 ♀ 10 mm. 5. Sta. 235, 2 ♀♀ 5·5 and 7 mm. 6. Sta. 237, 8 ♀♀ 7–9 mm. 7. Sta. 238, 2 ♀♀ 8 and 9 mm. 8. Sta. 250, 2 ♀♀ 7–8 mm. 9. Sta. 269, Antarctic; 2 ♀♀ 11 and 12 mm. 10. Sta. 306, 3 ♀♀ 10–12 mm. 11. Sta. 307, 3 ♀♀ 7·5–8 mm. 12. Label: ? Winter Cruise, 4 ♀♀ 8–10 mm.

Distribution.—Mediterranean; Atlantic, 47° N.–36° S.; Indian and Pacific Oceans; Antarctic, 58°–66° S., 85°–89° E. ("Gauss").

Gen. ANCHYLOMERA, M. Edw.

Stebbing, 1888, p. 1432; Bovallius, 1889, p. 408.

Anchylomera blossevillei, M. Edw.

Stebbing, 1888, p. 1433, pl. 177; Bovallius, 1889, p. 412, pl. 17, figs. 1–22; Vosseler, 1901, p. 88, fig. 4; Stephensen, 1924, p. 134, chart 20; Chevreux and Fage, 1925, p. 414, fig. 410; Shoemaker, 1925, p. 42; Spandl, 1927, p. 167, fig. 7, and p. 281 (variability).

Occurrence.—Atlantic, North: 1. Sta. 53, 1 ♂ 5·5 mm., 1 ♀ 4·5 mm., 1 juv. 3 mm. 2. Sta. 59, 1 ♂ 4 mm., 2 ♀♀ 3·5 mm., 4 juv. 2·5–3 mm. 3. Sta. 61, 2 ♂♂ 4·5 mm., 16 ♀♀ 3·5–4 mm. 4. Sta. 67, 2 ♀♀ 3·5–4 mm. New Zealand: 5. Sta. 85, 2 juv. 2·5–3 mm. 6. Sta. 93, 14 juv. 3–5 mm. 7. Sta. 106, 6 juv. 2–3·5 mm. 8. Sta. 109, 1 ♀ 6·5 mm., 24 juv. 2·5–4 mm. 9. Sta. 126, 1 ♀ 3·5 mm., 1 juv. 2·5 mm. 10. Sta. 130, 1 ♂ 10 mm., 1 ovig. ♀ 9 mm., 3 ♀♀ 6·5–7·5 mm., 2 juv. 3–4 mm. 11. Sta. 133, 4 ♀♀ 3·5–4·5 mm., 9 juv. 2·5–3 mm.

Distribution.—Mediterranean; Atlantic, 43° N.–38° S.; Indian Ocean; Pacific, $26\frac{1}{2}$° N.–40° S. and off Californian coast.

Family LYCAEOPSIDAE.

Chevreux and Fage, 1925, p. 417; Stephensen, 1925 a, p. 153.

Gen. LYCAEOPSIS, Claus.

Stebbing, 1888, p. 1451 (*Phorcorrhaphis*), and p. 1458; Chevreux, 1913 a, p. 16 *sqq.* (*Lycaeopsis* =♀, *Phorcorrhaphis*=♂); Chevreux and Fage, 1925, p. 417; Stephensen, 1925 a, p. 153; Spandl, 1927, p. 213 (key to two species, p. 215).

Lycaeopsis themistoides, Claus.

Stebbing, 1888, p. 1455, pl. 181 (*edwardsi* ♂), p. 1459, pl. 209 c (*pauli* ♀), and p. 1457; Chevreux, 1913 a, p. 16, figs. 6–8; Chevreux and Fage, 1925, p. 417, fig. 412; Stephensen, 1925 a, p. 153, chart 23; Spandl, 1924, p. 28, fig. 4 (*edwardsi*), and 1927, p. 213, fig. 35.

Occurrence.—1. Sta. 66, Atlantic, North; 1 ♂ 3·5 mm. 2. Sta. 84, New Zealand, 1 ♀ 4 mm. 3. Sta. 86, New Zealand; 1 ♀ 3·5 mm.

Remarks.—It seems strange that Chevreux (1913, p. 23) should consider *pauli* (with broad telson) synonymous with the following species, *zamboangae* (with narrow telson), instead of with the present species, especially as he had both sexes of both species.

The identification of Walker's specimens with *reynaudii*, M. Edw. (1909, Trans. Linn. Soc. Lond. xiii, 1, p. 53, spelt in error *raynaudii*) appears to be based solely on similarity of locality.

Distribution.—Mediterranean; Atlantic, 36°–26° N., and St. Paul Island; Red Sea; North Pacific, 24° N.; off Australia.

Lycaeopsis zamboangae (Stebb.).

Stebbing, 1888, p. 1452, pl. 180 (♂), and pp. 1458, 1459; Chevreux, 1900, p. 148, pl. 18, fig. 1; and 1913 a, p. 22, fig. 9 (♀); Spandl, 1924, p. 27, fig. 3; and 1927, p. 213.

Occurrence.—1. Sta. 64, Atlantic, North; 1 ♀ 3 mm. 2. Sta. 311, Atlantic, South, 1 ♂ 4 mm.

Distribution.—Atlantic: Madeira, Azores, 20° N., 10° S.; Red Sea; Philippine Islands; South Pacific, 40° S., 132° W.

Family PRONOIDAE.

Stephensen, 1925 a, p. 155; Spandl, 1927, p. 216 (key to genera).

Spandl does not mention in his key the genus *Paralycaea*, which is referred to this family; also there appears to be a misprint: the words about the telson (short and completely rounded) apply to *Sympronoë* but not to *Parapronoë*.

Gen. EUPRONOË, Claus.

Stephensen, 1925 a, p. 156; Spandl, 1927, p. 222.

Eupronoë minuta, Claus.

Stebbing, 1888, p. 1513 (*pacifica*=juv. ♂) and p. 1516; Chevreux, 1913 a, p. 7, figs. 2, 3; Chevreux and Fage, 1925, p. 425, fig. 417; Stephensen, 1925 a, p. 160, figs. 55, 56; Spandl, 1927, p. 223, fig. 41.

Occurrence.—New Zealand: 1. Sta. 89, 20 ♂♂ 3·5–4·5 mm. 2. Sta. 92, 1 ♂ 4·5 mm. 3. Sta. 110, 1 ♂ 4·5 mm. 4. Sta. 113, 1 ♀ 3 mm. 5. Sta. 133, 2 ovigerous ♀♀ 3·5 and 4 mm.

Distribution.—Mediterranean; Atlantic about 36°–31° N.; Canaries; Azores; Pacific, 37° N. (*pacifica*) and 40° S.

Eupronoë maculata, Claus.

Stebbing, 1888, p. 1510, pl. 187 (*inscripta*); Stephensen, 1925 a, p. 156, figs. 53, 54, chart 24; Spandl, 1927, p. 222.

Occurrence.—1. Sta. 89, 7 ♂♂ 9–10 mm. 2. Sta. 110, 1 ♂ 9 mm. 3. Sta. 139, 1 ♀ 5 mm.

Remarks.—Both the peraeon and pleon segments are marked with fine transverse lines.

Distribution.—Mediterranean; Atlantic about 40° N.–29° S.; Indian Ocean (Zanzibar and Ceylon); Pacific (China and Japanese Seas).

Eupronoë armata, Claus.

Stebbing, 1888, p. 1517, pl. 188 (*intermedia*); Stewart, 1913, p. 262; Stephensen, 1925 a, p. 159; Spandl, 1927, p. 224, fig. 42, and p. 222 (*intermedia*).

Occurrence.—Sta. 311, 2 ♂♂ 5–6 mm., 2 ♀♀ 4 mm.

Distribution.—Atlantic about 43° N.–38° S.; Indian Ocean: Zanzibar, Madagascar, and East Indies.

Gen. PARAPRONOË, Claus.

Stephensen, 1925 a, p. 165; Spandl, 1927, p. 219.

Omitting *P. cuspidata* (Bate) from consideration, it would seem that there are really only two species in this genus. Stephensen is inclined to regard *atlantica*, *clausi*, and *clausoides* as synonyms of *crustulum*, and I cannot see any reason for distinguishing *similis*, Spandl, or *stebbingi*, Spandl (=*crustulum*, Stebb., 1888) from this same species.

The two species are distinguished thus:

1. Head rounded in front. 5th joint gnathopod 1 tapering distally. Front margin of 2nd joint peraeopod 3 convex, somewhat angular .. .. .. *crustulum*
2. Head pointed in front. 5th joint gnathopod 1 not tapering distally. Front margin of 2nd joint peraeopod 3 nearly straight, even .. .. .. *campbelli*

Parapronoë campbelli, Stebb.

Stebbing, 1888, p. 1522, pl. 189; Chevreux, 1900, p. 152.

Occurrence.—New Zealand: 1. Sta. 89, 6 ♂♂ 9–10 mm. 2. Sta. 92, 1 ♂ 10 mm.

Remarks.—Gnathopod 1 has no bend in the 2nd joint, and the denticles on hind margin of 5th joint are often united into groups of 2–3 to form compound teeth.

Distribution.—Atlantic (Azores); Pacific, 35° N.

Gen. PARALYCAEA, Claus.

Stebbing, 1888, p. 1567; Stephensen, 1925 a, p. 165.

Paralycaea gracilis, Claus. (Fig. 56.)

Stebbing, 1888, p. 1568; Stephensen, 1925 a, p. 165, fig. 62.

Occurrence.—Sta. 106, New Zealand; 1 ♀ 3·5 mm.

Remarks.—Peraeopod 3 is not pectinate; 5th joint of peraeopod 4 is also not pectinate. Gnathopods 1, 2 and peraeopod 4 without any setules. Peraeopods 1 and 2 are also without setules, but 5th joint has a minute point at apex of hind margin and 2–3 minute setules. Inner ramus of uropod 2 is coalesced with peduncle.

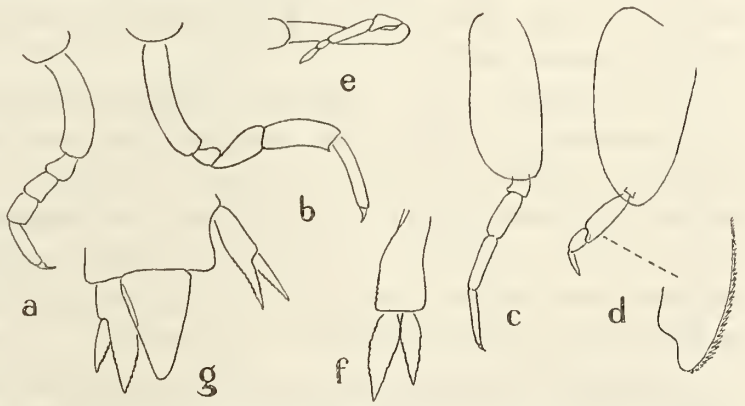

Fig. 56.—*Paralycaea gracilis*, Claus. *a*, gnathopod 2; *b*, peraeopod 1; *c*, peraeopod 3; *d*, peraeopod 4; *e*, peraeopod 5; *f*, uropod 1; *g*, telson and uropods 2 and 3.

Distribution.—Mediterranean ; Atlantic about 53° N., 47° N., and tropics ; Pacific, 39° S., 140° E.

Family LYCAEIDAE.

Stebbing, 1888, p. 1538 (*Tryphanidae* part) ; Chevreux and Fage, 1925, p. 426 ; Stephensen, 1925 a, p. 167 ; Spandl, 1927, p. 211.

Gen. TRYPHANA, Boeck.

Stebbing, 1888, p. 1538 ; Stephensen, 1925 a, p. 171.

Tryphana malmi, Boeck.

Stebbing, 1881, p. 1539, pl. 194 (*boecki*) ; G. O. Sars, 1895, p. 17, pl. 7 ; Stephensen, 1925 a, p. 171.

Occurrence.—New Zealand : 1. Sta. 89, 6 ♂♂ 4 mm. 2. Sta. 107, 1 ovig. ♀ 3 mm.

Remarks.—There are no differences between these specimens and the figures of Stebbing and Sars. The lower margins of pleon segments 1–3 agree better with Stebbing's description and figures than with Sars' figures.

The discovery of this species in the Pacific Ocean is very interesting, as hitherto it has only been captured in the Atlantic.

Distribution.—Atlantic about 67½°–18° N.

Gen. LYCAEA, Dana.

Chevreux and Fage, 1925, p. 429 ; Stephensen, 1925 a, p. 167 ; Spandl, 1924, p. 30, and 1927, p. 212.

This genus has not been dealt with adequately by recent authors. Spandl was not able to re-examine Claus' material. The identification of the present material, comprising 4 ♂♂ and 11 ♀♀, has been, therefore, beset with difficulties, and I cannot maintain that the identifications are absolutely certain. Taking the material as a whole, and such detailed figures in the literature as are available, I have noted the following general points.

The armature, if any, of the 5th and 6th joints of gnathopod 2 is never so strong as in gnathopod 1, except in the specimens here identified as *pauli*, where there is no appreciable difference (*Lycaea* sp., Spandl, 1927, is also an exception). The outer margins of the outer rami of uropods 2 and 3 are smooth ; all the other margins of the uropodal rami are serrate, as also the outer distal margin of the peduncle of uropod 1, and inner distal angle of the peduncle of uropods 1 and 2 (except where in the latter the inner ramus is coalesced with the peduncle).

Further, there appears to be a curious correlation between the presence of a bulge on the anterior margin of the 2nd joint of peraeopod 4 and long dactyli on peraeopods 1–4, though here again Spandl's *Lycaea* sp. seems to be an exception.

Lastly, the apical tooth on the 6th joint of gnathopods 1 and 2 is always well developed except in *gracilis*, where it is absent on gnathopod 2, and *serrata* and *Lycaea* sp. (which is probably referable to *serrata*), where it is absent on both the gnathopods.

I have ventured to draw up the following synopsis of the genus, which must be regarded, however, as purely provisional

I. Peraeopod 5, 2nd joint " elongate " (Bovallius) and cf. Dana's figure .. *stebbingi*
ochracea

II. Peraeopod 5, 2nd joint broad.

A. Inner ramus of uropod 2 coalesced with peduncle.

1. Peduncle of uropod 1 5 times length of rami. 2nd joint of peraeopod 4 bulging. Dactyli of peraeopods 1–4 long .. *bovallii*
2. Peduncle of uropod 1 4 times length of rami. 2nd joint of peraeopod 4 oval. Dactyli of peraeopods 1–4 short .. .. *nasuta*

B. Inner ramus of uropod 2 not coalesced.

1. 2nd joint of peraeopod 4 oval. Dactyli of peraeopods 1–4 short.
   a. Peduncle of uropod 1 $2\frac{1}{2}$–3 times length of rami.
      i. Inner ramus of uropod 3 straight .. .. .. *pulex*
      ii. Inner ramus of uropod 3 more or less curved .. .. *vincentii*
   b. Peduncle of uropod 1 twice length of rami .. .. .. *pauli*
2. 2nd joint of peraeopod 4 bulging. Dactyli of peraeopods 1–4 long.
   a. Peduncle of uropod 1 thrice length of rami.
      i. 6th joint of peraeopod 3 smooth.. .. .. .. *bovallioides*
      ii. 6th joint of peraeopod 3 serrate .. .. *bajensis*
   b. Peduncle of uropod 1 twice length of rami.
      i. 6th joint of gnathopod 2 tapering distally .. .. *gracilis*
      ii. 6th joint of gnathopod 2 apically produced .. .. *serrata*

Stephensen (1925 a, p. 169) says that *bovallioides* " agrees in all respects with *bovallii* except in the uropods. . . ." I take this to imply that the 6th joint of peraeopod 3 is smooth as it is in *bovallii*.

L. longicornuta, Giles, may be the same as *bajensis*, but unless Giles' type specimens can be re-examined the identity must remain uncertain.

Lycaea vincentii, Stebb. (Fig. 57.)

Stebbing, 1888, p. 1563, pl. 199.

Occurrence.—Sta. 43, Atlantic, North ; 1 ♂ 6 mm., 1 ♀ 6 mm.

Description.—Gnathopod 1, 5th joint with lower margin denticulate, palm serrulate, 6th joint with lower margin smooth, lower apical angle slightly produced. Gnathopod 2 similar, but 5th joint with lower margin smooth, and palm less strongly serrulate. *Peraeopods* 1–4, dactyli short. Peraeopods 1 and 2, 5th joint with hind margin distally, and 6th joint with whole hind margin minutely serrulate. Peraeopod 3, 5th joint with anterior margin distally, and 6th joint with whole anterior margin serrulate. Peraeopod 4,

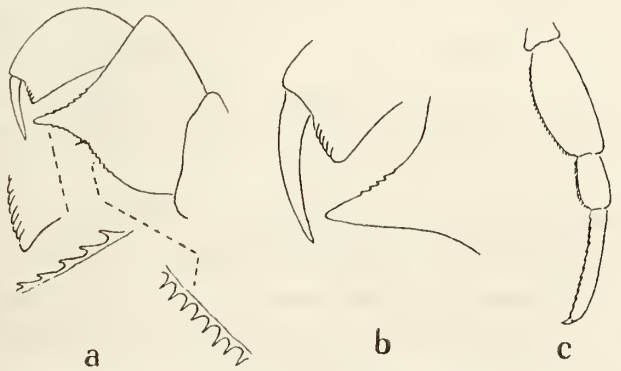

Fig. 57.—*Lycaea vincenti*, Stebb. *a*, gnathopod 1 ; *b*, gnathopod 2 ; *c*, peraeopod 4.

2nd joint with anterior margin evenly convex, 4th, 5th, and 6th joints with anterior margin serrulate. Peraeopod 5, 2nd joint broadly ovate, remaining joints together scarcely half length of second. *Uropod* 1, peduncle thrice length of rami. Uropod 2, inner ramus articulated. Uropod 3, inner ramus straight in ♀, slightly curved in ♂.

Remarks.—Except in the 3rd uropod (and of course the antennae) there appears to be no sexual difference in the appendages.

Whether this species should be united with *pulex* I have no means of deciding. Chevreux and Fage (1926) figure the 2nd joint of peraeopod 5 in *pulex* as more elongate than in *vincentii*.

Lycaea pauli, Stebb. (Fig. 58.)

Stebbing, 1888, p. 1566.

Occurrence.—New Zealand: 1 Sta. 109, 1 ♀ 6 mm. 2. Sta. 118, 1 ♀ 6·5 mm. 3. Sta. 131, 2 ♂♂ (penultimate stage) 6–6·5 mm., 1 ovigerous ♀ 7 mm. 4. Sta. 139, 2 ♀♀ 5·5–6·5 mm., 1 ♀ (with uterine ova) 7 mm. 5. Sta. "Winter Cruise?" 2 ♀♀ (1 spent, 1 with uterine ova) 7 mm.

Description.—*Gnathopods* 1 and 2 alike, 5th joint with hind margin obscurely crenulate, palm serrate, 6th joint with lower margin smooth, lower apical angle slightly produced. *Peraeopods* 1–4, dactyli short. Peraeopods 1 and 2 smooth. Peraeopod 3 smooth except a few serrations on distal anterior margin of 5th joint, neither 4th nor 5th joints dilated. Peraeopod 4, 2nd joint with anterior margin evenly convex, distal margin much wider than 3rd joint, 4th joint distally and whole of 5th and 6th joints rather strongly serrulate on anterior margins. Peraeopod 5 broadly ovate, hind margin very convex, remaining joints together scarcely equal to half length of 2nd joint. *Uropod* 1, peduncle twice length of rami. Uropod 2, inner ramus articulated. Uropod 3, inner ramus straight.

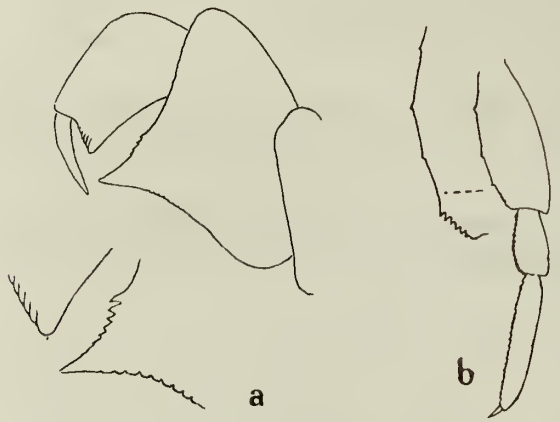

Fig. 58.—*Lycaea pauli*, Stebb. *a*, gnathopod 1; *b*, peraeopod 4.

Remarks.—These specimens seem to be nearest to *pauli*, Stebb.

Distribution.—St. Paul's Rocks, Equatorial Atlantic.

Lycaea nasuta, Claus. (Fig. 59.)

Claus, 1887, p. 62, pl. 18, figs. 1–7.

Occurrence.—Sta. 118, New Zealand; 1 ovigerous ♀ 7 mm.

Description.—*Head* globular, without frontal projection. *Gnathopods* 1 and 2, 5th and 6th joints without any of the usual serrations on margins, 6th joint with lower

apical angle rounded-quadrate, not angularly produced. *Peraeopods* 1–4, dactyli short. Peraeopods 1–3, all joints smooth, neither 4th nor 5th joint in peraeopod 3 dilated. Peraeopod 4, 2nd joint regularly oval, 4th joint with a few spaced denticles on anterior margin, and serrulate distally, 5th and 6th joints serrulate. Peraeopod 5, 2nd joint oval, about twice as long as the remaining joints together. *Uropod* 1, peduncle 4 times

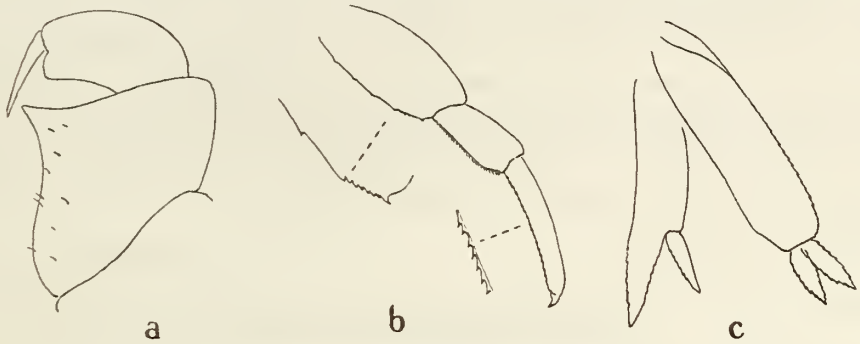

Fig. 59.—*Lycaea nasuta*, Claus. *a*, gnathopod 1; *b*, peraeopod 4; *c*, uropods 1 and 2.

length of rami. Uropod 2, inner ramus coalesced with peduncle. Uropod 3, inner ramus straight.

Remarks.—The main reason for identifying this specimen with Claus' species lies in uropods 1 and 2. The lower distal angle of 6th joint of gnathopods 1 and 2 is not angularly produced as it is in Claus' figure.

Distribution.—Zanzibar.

Lycaea bajensis, Shoemkr. (Fig. 60.)

Shoemaker, 1925, p. 46, figs. 16, 17.

Occurrence.—New Zealand: 1. Sta. 85, 1 ♂ 4·5 mm. 2. Sta. 89, 1 ovigerous ♀ 4·5 mm.

Description.—Gnathopods 1 and 2, 5th joint serrate on both lower margin and palm, 6th joint with lower margin serrate, lower apical angle acutely produced; serrations stronger in peraeopod 1 than in peraeopod 2. *Peraeopods* 1–4, dactyli long. Peraeopods 1 and 2 smooth. Peraeopod 3 smooth except anterior margin of 6th joint which is minutely setulose, neither 4th nor 5th joints dilated. Peraeopod 4, 2nd joint with bulge on anterior margin, anterior margin of 6th joint with a few very feeble denticles and setulose apically. Peraeopod 5, 2nd joint broad, irregularly ovate, the hind margin subangularly convex, remaining joints together forming a very small

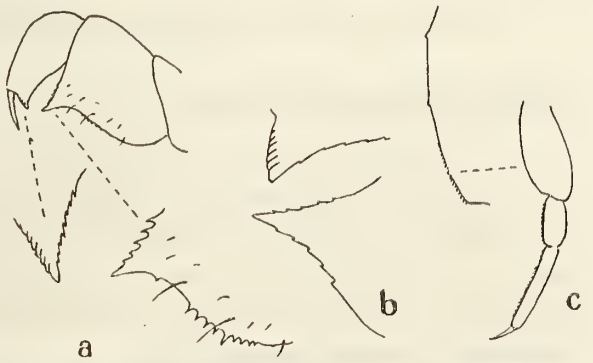

Fig. 60.—*Lycaea bajensis*, Shoemkr. *a*, gnathopod 1; *b*, apices of 5th and 6th joints of gnathopod 2; *c*, peraeopod 4.

appendage, unguis hook-like. *Uropod* 1, peduncle $2\frac{1}{2}$ (♂)–3 (♀) times length of rami. Uropod 2, inner ramus articulated. Uropod 3, inner ramus straight.

Remarks.—If Dana's description and figure of the 2nd joint of peraeopod 5 as narrow and as long as 2nd joint of peraeopod 4 are correct, these specimens cannot be identified as *ochracea*, recorded by Dana from north of New Zealand. They agree in all respects with *bajensis*, except that Shoemaker says the hind margin of 6th joint in gnathopod 2 has no serrations. *L. serrata*, Claus, is clearly distinct in the shape of the 6th joint of gnathopods 1 and 2, peraeopod 3, and uropod 1. On the other hand, *bajensis* may prove synonymous with *longicornuta* (Giles), though Giles does not give exactly the requisite details. *L. gracilis* is distinguished by the shape of the 6th joint of gnathopod 2, but otherwise seems to be closely allied.

Distribution.—California.

Family BRACHYSCELIDAE.

Stephensen, 1925 a, p. 171.

Gen. BRACHYSCELUS, Bate.

Stephensen, 1925 a, p. 172.

Brachyscelus crusculum, Bate.

Stewart, 1913, p. 262 ; Chevreux and Fage, 1925, p. 427, fig. 418 ; Stephensen, 1925 a, p. 172, chart 26 ; Spandl, 1927, p. 210.

Occurrence.—1. Sta. 59, Atlantic, North ; 1 ♀ 7 mm., 3 juv. 4 mm. New Zealand : 2. Sta. 100, 1 ♂ 11 mm., 1 juv. 5 mm. 3. Sta. 101, 1 ♂ (immature) 9 mm. 4. Sta. 109, 4 ♂♂ (immature) 6–9 mm., 1 ♀ 8 mm., 4 juv. 3–5 mm. 5. Sta. 126, 2 juv. 6–7 mm. 6. Sta. 130, 2 juv. 5·5–6 mm., 3 juv. 3–3·5 mm. 7. Sta. 139, 4 juv. 3·5–7 mm. 8. Sta. 142, 1 ♀ 7 mm., 1 juv. 4 mm.

Distribution.—Mediterranean ; Atlantic, 51° N.–32° S. ; North Pacific.

Brachyscelus rapacoides, Steph.

Stephensen, 1925 a, p. 179, figs. 67, 68.

Occurrence.—Sta. 109, New Zealand ; 1 ♂ 5 mm.

Remarks.—Agrees with Stephensen's account, but peraeopods 1 and 2 are entirely smooth. The lower distal corner of 5th joint of gnathopods 1 and 2 is markedly rounded, i.e. no one tooth can be regarded as a terminal tooth ; the large teeth are separated by several smaller ones.

Distribution.—Mediterranean ; Bay of Bengal.

Family OXYCEPHALIDAE.

Bovallius, 1890 (key to genera) ; Stephensen, 1925 a, p. 182 ; Spandl, 1927, p. 178 (key to genera).

Gen. SIMORHYNCHOTUS, Stebb.

Bovallius, 1890, p. 47 ; Spandl, 1927, p. 211.

Stephensen apparently did not utilise his material for solving the question of the maxillae. Spandl gives no positive evidence for removing the genus to the *Lycaeidae*. In all the specimens in the present collection I have found the maxillae to be quite rudimentary or obsolete. If this be a crucial character, then the genus seems to be rightly placed in the *Oxycephalidae*.

Stephensen sinks *lilljeborgi* as a synonym of *antennarius*, while Spandl maintains its distinctness. Both authors incline to the view that *stebbingi* is a synonym of *antennarius*.

Simorhynchotus antennarius (Claus).

Stebbing, 1881, p. 1572, pl. 200 ; Bovallius, 1890, pp. 49, 50 (*stebbingi*) ; Stephensen, 1925 a, p. 185, fig. 72 (♀) ; Spandl, 1927, p. 211, fig. 32.

Occurrence.—Atlantic, North : 1. Sta. 40, 6 ♂♂ 5–6 mm. 2. Sta. 50, 1 ♂ 5 mm., 1 ♀ 3·5 mm. 3. Sta. 66, 1 ♂ 6 mm. 4. Sta. 67, 1 ♂ 4 mm. New Zealand : 5. Sta. 89, 2 ♂♂ 6·5 mm. 6. Sta. 92, 7 ♀♀ 4–5 mm. 7. Sta. 100, 2 ♂♂ (penultimate instar) 4 mm. 8. Sta. 106, 2 ♂♂ 6 mm. 9. Sta. 110, 1 ♂ 6·5 mm. 10. Sta. 127, 1 ♂ 6·5 mm. 11. Sta. 130, 1 ♀ 5 mm., 2 juv. 4 mm. 12. Sta. 131, 1 ♂ 6·5 mm., 2 ♂♂ (penultimate instar) 5–5·5 mm.

Remarks.—There are several forms of the inner ramus of uropod 3 transitional between Stebbing's figure and those of Stephensen and Spandl. In the ♀ the 4th joint of gnathopod 1 is distinctly oval, contrary to what Stephensen found in his material.

Distribution.—Mediterranean ; Atlantic, Indian, and Pacific Oceans.

Gen. OXYCEPHALUS, M. Edw.

Bovallius, 1890, p. 54 ; Spandl, 1927, p. 179.

Oxycephalus piscator, M. Edw.

Bovallius, 1890, p. 56, pl. 1, figs. 8–16, text-figs. 33, 35, 36, 37, 41, 42, 66, 68, 69, 75 ; Spandl, 1927, p. 180, fig. 13, *a–d*.

Occurrence.—Sta. 86, New Zealand ; 1 ♂ 27 mm.

Remarks.—The back is tuberculate as in *clausi* and *tuberculatus*, but the 1st and 2nd gnathopods resemble those of *piscator*.

Distribution.—Mediterranean ; temperate and tropical Atlantic, Indian, and Pacific Oceans.

Oxycephalus clausi, Bov.

Bovallius, 1890, p. 60, pl. 1, figs. 19–24 ; pl. 2, fig. 1, text-figs. 4, 7, 8, 22, 54, 65 ; Stephensen, 1925 a, p. 188, chart 27.

Occurrence.—Sta. 53, Atlantic, North ; 1 ♂ 18 mm.

Distribution.—Mediterranean ; Atlantic, Indian, and Pacific Oceans.

Gen. CALAMORHYNCHUS, Streets.

Bovallius, 1890, p. 72; Stephensen, 1925 a, p. 189, fig. 73 (♂); Spandl, 1927, p. 197.

Calamorhynchus pellucidus, Streets.

Bovallius, 1890, p. 73, pl. 2, figs. 14, 15 (after Streets); Spandl, 1927, p. 198, figs. 25, 26, *b*.

Occurrence.—1. Sta. 68, Atlantic, North; 1 ♀ 12 mm. New Zealand: 2. Sta. 86, 1 ♂ 15 mm. 3. Sta. 129, 2 ♂♂ 16 and 17 mm. 4. Sta. 130, 1 ♂ 15 mm.

Remarks.—Peraeopod 5 reaching to about $\frac{2}{3}$ of 4th joint of peraeopod 4 (♂) or to end of 5th joint (♀). 2nd joint of peraeopods 3 and 4 with smooth hind margin. Uropod 3 reaching to end of telson; uropod 1 reaching almost to end of telson and extending slightly beyond uropod 2, which reaches to apex of peduncle of uropod 3. Rami of uropod 2 rather better developed in both ♂ and ♀ than in Stebbing's figure of ♀ of *rigidus* (1888, pl. 206). Inner margin (distally) of peduncle of uropod 2 serrate in both sexes, though very feebly so in the ♂ from Sta. 130, and one of those from Sta. 129.

Unfortunately Stephensen makes no comment on the relative proportions of the uropods and telson in the males he refers to *rigidus;* nor does Spandl. Spandl records both *pellucidus* and *rigidus* from the same haul, ♀♀ of one of them, ♂♂ of the other, but does not state whether the ♀♀ were *pellucidus* (as one may perhaps assume from the last sentence on p. 198) or vice versâ. In my opinion it is still an open question whether *rigidus* should not be united with *pellucidus*.

Distribution.—Pacific, 28° 6′ N., 140° 12′ W. (Streets); Atlantic, 17° 28′ N., 29° 42′ W. ("Gauss"). *C. rigidus* is recorded from the Mediterranean and the North and South Atlantic (see Stephensen).

Gen. LEPTOCOTIS, Streets.

Stebbing, 1888, p. 1593; Bovallius, 1890, p. 110 and p. 75 (*Dorycephalus*); Colosi, 1918, p. 212 (*Dorycephalus*); Stephensen, 1925 a, p. 191; Spandl, 1927, p. 204 and p. 203 (*Dorycephalus*).

Stephensen justly points out the weakness of the argument which tries to uphold *Dorycephalus* as a distinct genus. Spandl claims to have found examples of *D. ambobus* and of two species (one a n. sp.) of *Leptocotis*, but beyond copying (pp. 178, 179) Bovallius' key to the Oxycephalid genera, he does not discuss the difference between the two alleged genera. Of *L. similis* he says (p. 206) "... die Uropoden ... zeigen keine besonderen Charakteristika, die sie von den anderen Formen (*L. tenuirostris*) unterscheiden," and omits all mention of the uropods of the specimens he describes as *tenuirostris*.

I agree with Stephensen in recognising but one species of this genus. *L. similis*, however, may be a second species, but it has resemblances in the 1st and 2nd gnathopods and 5th peraeopods to *Leptocotis* (? *Streetsia*) *mindanaonis*, Stebb., which itself bears a likeness to *S. longiceps* (Claus.).

Leptocotis tenuirostris (Claus).

Stebbing, 1888, p. 1594, pl. 205 (*ambobus*); Bovallius, 1890, p. 113, pl. 5, figs. 10–14, and p. 111, pl. 5, figs. 15–17 (*spinifera*), and p. 76, pl. 2, figs. 16–18; pl. 3, fig. 1, text-figs. 31, 39, 44, 50, 73, 77 (*D. lindströmi*); Colosi, 1918, p. 217, figs. 1–10 (*D. lindströmi* and *ambobus*); Stephensen, 1925 a, p. 191, fig. 74.

Occurrence.—Atlantic, North: 1. Sta. 45, 1 ♂ 11 mm. 2. Sta. 50, 1 ♀ 10·5 mm. New Zealand: 3. Sta. 92, 1 ♂ 11 mm. (in poor condition, encrusted with crystals of foreign matter). 4. Sta. 118, 1 ovig. ♀ 9 mm. 5. Sta. 120, 1 ♀ 10 mm. 6. Sta. 127, 1 ♀ 10 mm. 7. Sta. 130, 1 ♀ 9 mm. 8. Sta. 143, 1 ♀ with embryos 11 mm.

Remarks.—The postero-lateral angles of the 3rd pleon segment are sharply pointed, but none of the lower margins of pleon segments 1–3 appear to be serrated, as Streets and Stebbing say they are. The 2nd joint of peraeopod 5 has the somewhat angular hind margin shown in the figures of the authors quoted above. The inner ramus of uropod 3 is clearly coalesced with the peduncle. The coalesced 5th and 6th pleon segments are about 2 (♂)–2½ (♀) times as long as the telson. The upper front angle of the peduncle of 1st antenna ♂ strongly projecting.

The embryos resemble in general those of *Rhabdosoma brevicaudatum* figured by Stephensen (1925 a, p. 206, fig. 80), with short blunt head, short pleon with a minute telson, well-developed rami to all the uropods, and peraeopods 1–4 ending in a strong curved sickle formed by the 7th joint and the unguis.

Distribution.—Atlantic, Indian, and Pacific Oceans.

Gen. STREETSIA, Stebb.

Bovallius, 1890, p. 80; Spandl, 1927, p. 184 (key to species).

Streetsia porcellus (Claus).

Stebbing, 1888, p. 1587, 1589, pls. 203, 204 A; Stephensen, 1925 a, p. 192, chart 28 (*porcella*); Spandl, 1927, p. 188, figs. 20, 21 (*intermedia*).

Occurrence.—1. Sta. 49, Atlantic, North; 1 ♂ 14 mm. 2. Sta. 130, New Zealand; 1 ♀ 8 mm.

Remarks.—The distal process of the 4th joint of peraeopod 4, which Spandl regards as characteristic of his species, has already been figured by Stebbing. Too much reliance should not be placed on the comparative length of the 3rd–7th joints of peraeopod 5 in relation to the 2nd joint.

Distribution.—Mediterranean; Atlantic, Indian, and Pacific Oceans.

Streetsia challengeri, Stebb.

Stebbing, 1888, p. 1603, pl. 207; Stephensen, 1925 a, p. 194, fig. 75, chart 29 (synonymy and growth changes); Spandl, 1927, p. 186, figs. 18, 19.

Occurrence.—Atlantic, North: 1. Sta. 66, 1 juv. 7 mm. 2. Sta. 68, 1 juv. (♀) 8 mm. 3. Sta. 69, 3 juv. 6 mm. New Zealand: 4, Sta. 87, 1 ♀ 12 mm. 5. Sta. 113, 1 juv. 6 mm. 6. Sta. 118, 1 juv. (♀) 8 mm. 7. Sta. 130, 1 ♀ 15 mm., 1 juv. 6 mm.

Distribution.—Mediterranean; Atlantic, Indian, and Pacific Oceans.

Gen. RHABDOSOMA, Ad. and White.

Bovallius, 1890, p. 116 (*Xiphocephalus*) ; Stebbing, 1895, p. 367.

Rhabdosoma armatum, M. Edw.

Bovallius, 1890, p. 119, pl. 6, figs. 1–20, text-figs. 2, 57, 80 ; Spandl, 1927, p. 210.

Occurrence.—Sta. 46, Atlantic, North ; 1 ovig. ♀ 152 mm. (tip of rostrum to end of telson).

Remarks.—Bovallius gives 120 mm. as the maximum size. The present specimen therefore appears to constitute a record.

Distribution.—Tropical regions of the Atlantic, Indian, and Pacific Oceans.

Rhabdosoma whitei, Sp. Bate.

Bovallius, 1890, p. 125, pl. 7, figs. 1–20, text-figs. ; Spandl, 1927, p. 208, fig. 31.

Occurrence.—1. Sta. 45, Atlantic, North ; 1 ♂ 35 mm. 2. Sta. 311, Atlantic, South ; 4 juv. (? ♀) 15–21 mm. (somewhat damaged).

Distribution.—Atlantic, Indian, and Pacific Oceans.

Rhabdosoma brevicaudatum, Stebb.

Stebbing, 1888, p. 1612, pl. 208 ; Stebbing, 1895, p. 369, pl. 55 B (*brachyteles*=juv.); Stephensen, 1925 a, p. 205, figs. 77–80.

Occurrence.—Sta. 68, Atlantic, North ; 1 ovig. ♀ 23 mm. (tips of rostrum and uropod 3 broken off).

Remarks.—Uropod 2 is $1\frac{1}{2}$ times the length of the coalesced 5th and 6th pleon segments ; uropod 1 is a little longer, extending to the outer ramus of uropod 3.

Distribution.—Mediterranean ; Atlantic.

Family THYROPIDAE, nom. nov.

Stephensen, 1925 a, p. 207 (*Parascelidae*) ; Spandl, 1927, p. 250 (*Parascelidae*) (key to genera).

As there is no question that *Thyropus* is the oldest genus, the family name should be derived from it. It would have to be altered if *Parascelus* were made synonymous, and the crucial question in this family is whether *Parascelus* is really distinct from *Thyropus*.

Stephensen's *P. similis*, with the pocket on 2nd joint of peraeopod 4 and narrow uropodal rami, seems to indicate that there is no real distinction. The value of Spandl's differential character is whittled away by this same species, as well as by his own figures of *T. sphaeroma* (fig. 53, *f* and *f'*).

A thorough revision based on abundant material is required, and when such is carried out there will probably be a reduction in the number of species.

Gen. THYROPUS, Dana.

Stebbing, 1888, p. 1492 ; Spandl, 1927, p. 258.

Thyropus sphaeroma, Claus.

Stebbing, 1888, pl. 1492, pl. 210C (*danae* ♂), and p. 1495 ; Spandl, 1927, p. 259, figs. 53, 54, and p. 284, fig. 63.

Occurrence.—1. Sta. 47, Atlantic, North ; 2 ♂♂ 4 mm. 2. Sta. 61, Atlantic, North ; 5 ♂♂ 5 mm. 3. Sta. 310, Atlantic, South ; 1 ♀ about 7 mm.

Remarks.—The 2nd joint of peraeopod 5 in the ♀ is elongate, and there is the full complement of joints in the limb.

Distribution.—Tropical Atlantic.

Family PLATYSCELIDAE.

Claus, 1887, p. 30 ; Spandl, 1924, p. 34, and 1927, p. 227 (key to genera) ; Stephensen, 1925 a, p. 212.

Gen. PLATYSCELUS, Bate.

Claus, 1887, p. 31 (*Eutyphis*) ; Stephensen, 1925 a, p. 213 ; Spandl, 1927, p. 227 (key to species, p. 232).

Platyscelus serratulus, Stebb.

Claus, 1887, p. 37, pl. 3, figs. 5–14 (*serratus*, non Bate) ; Stebbing, 1888, p. 1470 ; Chevreux and Fage, 1925, p. 422, fig. 414 ; Shoemaker, 1925, pl. 51, figs. 20, 21 (*dubius*) ; Stephensen, 1925 a, p. 215, chart 31.

Occurrence.—New Zealand : 1. Sta. 89, 61, mostly ♂♂ 5–6 mm.* 2. Sta. 92, 4 ♂♂ 5–6 mm. 3. Sta. 106, 1 ♂ 5 mm. 4. Sta. 107, 3 ♂♂ 5 mm. 5. Sta. 109, 9 ♂♂ 5–6 mm., 3 ♀♀ 5 mm. 6. Sta. 120, 1 ♂ 5 mm. 7. Sta. 130, 2 ♂♂ 6 mm., 2 ovig. ♀♀ 5 mm. 8. Sta. 143, 1 ♂ 6 mm.

Remarks.—Peraeopod 5 is usually stouter than in Chevreux and Fage's figure, more like Shoemaker's figure ; with two terminal joints.

Distribution.—Mediterranean ; Atlantic, 42° N.–37° S. ; Indian Ocean (Zanzibar, Red Sea, Bay of Bengal) ; Pacific (Californian coast : *dubius*).

Gen. HEMITYPHIS, Claus.

Stebbing, 1888, p. 1471 ; Stephensen, 1925 a, p. 219 ; Spandl, 1927, p. 233 (key to the two species, p. 239).

Hemityphis rapax (M. Edw.).

Stebbing, 1881, p. 1472, pl. 183 (*tenuimanus*) ; Stephensen, 1925 a, p. 219 (*tenuimanus*) ; Spandl, 1927, p. 233, fig. 46 (*tenuimanus*).

Occurrence.—New Zealand : 1. Sta. 85, 1 ♀ 5 mm. 2. Sta. 139, 1 ♀ 3 mm.

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* For the same reason as given by Stephensen (p. 214), I have not examined every specimen in order to determine its sex.

Remarks.—In No. 1 the upper margin of the process of 5th joint of gnathopod 2 is serrulate.

Stephensen claims that *tenuimanus* is the same as *rapax*, though he does not adopt M. Edwards' name.

Distribution.—Mediterranean; Atlantic, Indian, and Pacific Oceans.

Gen. AMPHITHYRUS, Claus.

Stephensen, 1925 a, p. 225; Spandl, 1927, p. 246 (key to species, p. 250).

Stephensen finds intermediates between *similis* and *sculpturatus;* Spandl regards *similis* as a variety of *bispinosus*, and *orientalis* as synonymous with *sculpturatus*. Where such a conflict of opinion is possible, it is evident that the differential characters are not of a very high order.

Amphithyrus bispinosus, Claus.

Claus, 1887, p. 41, pl. 6, figs. 4–16; Stephensen, 1925 a, p. 225; Spandl, 1927, p. 247, fig. 50.

Occurrence.—Atlantic, North: 1. Sta. 53, 2 ♀♀ 3 mm. 2. Sta. 68, 1 ♂ 4 mm. New Zealand: 3. Sta. 89, 9 ♂♂ 4·5 mm. 4. Sta. 93, 1 ♂ 4 mm. 5. Sta. 107, 1 ♂ 4·5 mm.

Distribution.—Mediterranean; Atlantic; Indian Ocean (Bay of Bengal); Pacific Ocean (China Sea).

Amphithyrus glaber, Spandl.

Spandl, 1924, p. 40, fig. 13.

Occurrence.—Sta. 47, Atlantic, North; 2 ♂♂ 3·5 mm.

Remarks.—These specimens are identified with *glaber* solely on account of the shape of the 5th peraeopod, though in my opinion this character, owing to the known variability of a limb subject to reduction, cannot be used to differentiate species. I think that *glaber* is, at the most, a variety of *orientalis*, which is synonymous with *sculpturatus*.

Distribution.—Red Sea.

Gen. PARATYPHIS, Claus.

Stephensen, 1925 a, p. 220 (key to species); Spandl, 1927, p. 243 (key to species, p. 246).

There is still considerable confusion and conflict in this genus. Stephensen in his key separates *clausii* from the other species on account of the evenly rounded apex of the 2nd joint of peraeopod 3; but this feature is found in Spandl's figures of *maculatus* (1927, fig. 49) and *spinosus* (1924, fig. 10). The long groove in the 2nd joint of peraeopod 4 is said to be a feature of *clausii* by Stephensen, and of *spinosus* by Spandl. The latter author in 1927 regards these two species as distinct on account of the difference in length of this slit, though the figures show no difference.

Paratyphis spinosus, Spandl.

Spandl, 1924, p. 36, fig. 10, and 1927, p. 245 ; Stephensen, 1925 a, p. 221, fig. 85 (*clausii*).

Occurrence.—Sta. 107, New Zealand ; 1 ♂ 5 mm.

Distribution.—Red Sea (Spandl) ; Mediterranean and China Sea (Stephensen).

Paratyphis parvus, Claus.

Claus, 1887, p. 40, pl. 7, figs. 13–21 ; Chevreux, 1900, p. 150 ; Stewart, 1913, p. 259.

Occurrence.—Atlantic, North : 1. Sta. 68, 2 ♂♂ 3·5 mm. New Zealand : 2. Sta. 86, 1 ♂ 5 mm., 4 juv. 3–4 mm. 3. Sta. 92, 4 ♂♂ 4 mm., 1 ♀ 3·5 mm. 4. Sta. 107, 8 ♂♂ 4 mm. 5. Sta. 127, 2 ♂♂ 4 mm.

Remarks.—The process of 5th joint of gnathopod 2 is notched where the setae are inserted. Peraeopod 5 has a rudimentary appendage at the apex of 2nd joint. The outer ramus of uropod 3 is about half, sometimes a little more than half, the length of inner ramus.

Distribution.—Lagos (Claus) ; Azores (Chevreux) ; 13° 59′ S. (Stewart).

Gen. TETRATHYRUS, Claus.

Stephensen, 1925 a, p. 224 ; Spandl, 1927, p. 240 (key to species, p. 243).

Although this genus seems already overburdened with species, the number of which will probably be reduced when more material is available, I feel constrained to propose a new species here for a single specimen from the New Zealand area.

Tetrathryrus forcipatus, Claus.

Chevreux and Fage, 1925, p. 422, fig. 415 ; Shoemaker, 1925, p. 54, figs. 22–24 (*sancti-josephi*) ; Stephensen, 1925 a, p. 224 ; Spandl, 1927, p. 240, fig. 48.

Occurrence.—Atlantic, North : 1. Sta. 53, 3 ♂♂ 4 mm., 3 ♀♀ (1 ovig.) 4 mm., 3 juv. 2–3 mm. 2. Sta. 61, 1 ♂ (immature) 3·5 mm. 3. Sta. 68, 2 ♂♂ 4 mm., 1 ♀ 4 mm. New Zealand : 4. Sta. 209, 1 ♀ 3 mm.

Distribution.—Mediterranean ; Atlantic, 42° N.–34° S. ; Red Sea ; Californian coast (*sancti-josephi*).

Tetrathyrus pulchellus, n. sp. (Fig. 61.)

Occurrence.—Sta. 109, New Zealand ; 1 ♂ 3·5 mm.

Description.—Peraeon and pleon, and side-plates, and 2nd joints of peraeopods 3 and 4, but not the telson, with hexagonal sculpturing. Peraeopod 3 with 3rd–6th joints smooth. Peraeopod 4 with 2nd joint narrower than in the figures of other species, evenly tapering ; 4th joint very broad at its middle, tapering distally, front margin pectinate ; 5th joint much narrower than 4th, margin quite

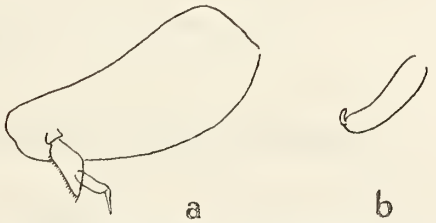

Fig. 61.—*Tetrathyrus pulchellus*, n. sp. *a*, peraeopod 4 ; *b*, peraeopod 5.

smooth. Peraeopod 5 narrow, curved, with crinkled appendage distally. Other characters as in *forcipatus*.

Remarks.—The 4th joint of peraeopod 4 seems to be quite distinctive.

3. CAPRELLIDAE.

Family CAPRELLIDAE.

Mayer, 1890 and 1903; Raj, 1927 (Bull. Madras Govt. Mus. n.s. I), p. 125.

Gen. CAPRELLA, Linn.

Mayer, 1903, pp. 14, 72.

Caprella equilibra, Say.

Mayer, 1903, p. 89, pl. 3, figs. 29–34, pl. 7, figs. 66–69 (*aequilibra*).

Occurrence.—Sta. 50, Atlantic, North; 1 ♀ 5 mm.

Remarks.—The identification is not absolutely certain as only a ♀ is present.

Distribution.—Widely distributed: N. and S. Atlantic, Indo-Pacific.

Gen. CAPRELLINA, Thoms.

Mayer, 1903, pp. 14, 30; Barnard, 1916, p. 282.

Remarks.—Stebbing (1888, p. 223, and p. 1237) proposed the name *Caprellinopsis* because "Caprellina" had already been used for the whole group. Mayer would not admit the necessity for this change, probably because "Caprellina" in the older sense is no longer used; and Stebbing himself in his General Catalogue of S. African Crustacea (1910) reverted to Thomson's original name.

A similar case is the name *Amphipoda*, proposed by Williamson in 1916 as a *genus* of *Amphipoda*. As the term "Amphipoda" is in general use for one of the Orders of Crustacea, its use for a genus seems quite inadmissible.

Caprellina longicollis (Nicolet).

Mayer, 1903, pp. 30, 143; Hutton, 1904 (Ind. Faun. Nov. Zeal.), p. 261 (*longicollet* typ. err.). Chilton, 1909, p. 648; Stebbing, 1910 (Gen. Cat. S. Afr. Crust.), p. 470.

Occurrence.—Sta. 134, New Zealand; several ♂♂ and ♀♀ 5–11 mm.

Distribution.—Chile; South Africa; New Zealand and The Snares.

Gen. CAPRELLINOIDES, Stebb.

Stebbing, 1888, p. 1237; Mayer, 1890, p. 87, and 1903, p. 57; Schellenberg, 1926 a, p. 467.

Remarks.—The genus is austral and comprises *tristanensis*, Stebb., from Tristan d'Acunha, *mayeri* from South Georgia, *antarctica*, Schell., from the "Gauss" winter station, and the present new species.

Caprellinoides spinosa, n. sp. (Fig. 62.)

Occurrence.—Antarctic: 1. Sta. 220. Several ♂♂ up to 18 mm., and ♀♀ up to 10 mm. 2. Sta. 316, 1 ♀ 11 mm.

Description.—*Medio-dorsal spines* present in both sexes as follows: one on the head; one on middle (or slightly behind middle) and one on posterior margin of each of segments 2, 3, 4, and 5. *Antenna* 1, flagellum 10–11-jointed in ♂, 6–7-jointed in ♀. *Antenna* 2, flagellum 4–5-jointed in ♂, 3–4-jointed in ♀. *Gnathopod* 2, suture between 5th and 6th joints indicated only near the dorsal margin, palm in ♂ with a pointed tooth in middle, and 2 blunter ones, unequal in size, near hinge, margin between basal

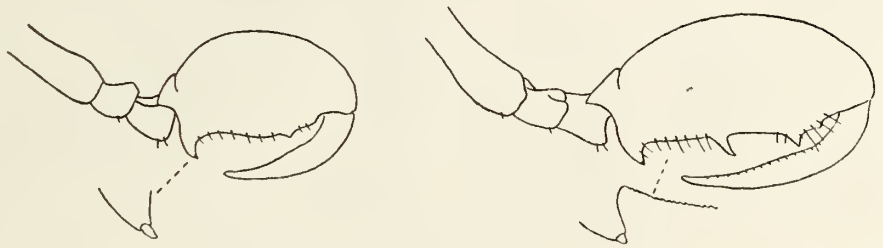

Fig. 62.—*Caprellinoides spinosa*, n. sp. *a*, gnathopod 2, ♀; *b*, gnathopod 2, ♂.

and middle teeth minutely serrulate; in ♀ with feeble indications of 2 teeth near hinge; basal tooth in both sexes terminated by a stout spine.

Remarks.—This species is close to *antarctica*, Schell.; in fact the hand of gnathopod 2 in ♂ might well be regarded as the fully grown form of that found in *antarctica*, and I should have identified these specimens with the "Gauss" species but for the complete absence of spines in the latter, which was founded on a ♀ with embryos as well as a ♂. The ♂ might have been immature, but the ♀ must be presumed to have attained its fully adult characteristics.

Gen. AEGINOIDES, Schell.

Schellenberg, 1926 a, p. 465.

Diagnosis.—Mouth-parts as in *Caprellina;* mandibular palp 3-jointed. Flagellum of antenna 2 5–8-jointed. Branchiae on segments 3 and 4 only. A minute 1-jointed appendage representing peraeopod 1; peraeopod 2 completely absent (or represented by a minute lamina: Schellenberg). Peraeopod 3 reduced, 4-jointed, the 4th joint forming a curved claw. Pleon with 2 pairs of 2-jointed appendages.

Remarks.—Closely allied to *Caprellina* and *Prellicana*, but differing from the former by the absence of branchiae on segment 2, from the latter by the presence of

2 pairs of appendages on the pleon, and from both by the presence of the rudimentary peraeopod on segment 3.

The greater number of joints in the flagellum of antenna 2 in the ♀ is to be attributed to the specimen being larger and older than the ♂. Schellenberg's specimens had only 4 joints.

Aeginoides gaussi, Schell. (Fig. 63.)

Schellenberg, 1926 a, p. 465, fig. 1.

Occurrence.—Antarctic: 1. Sta. 194, 1 ♀ 25 mm. 2. Sta. 220, 1 ♂ 13 mm.

Description.—*Body* smooth in ♂; in ♀ spinose as follows: a medio-dorsal forwardly-curving spine a little in front of middle of segment 2, a lateral forwardly-

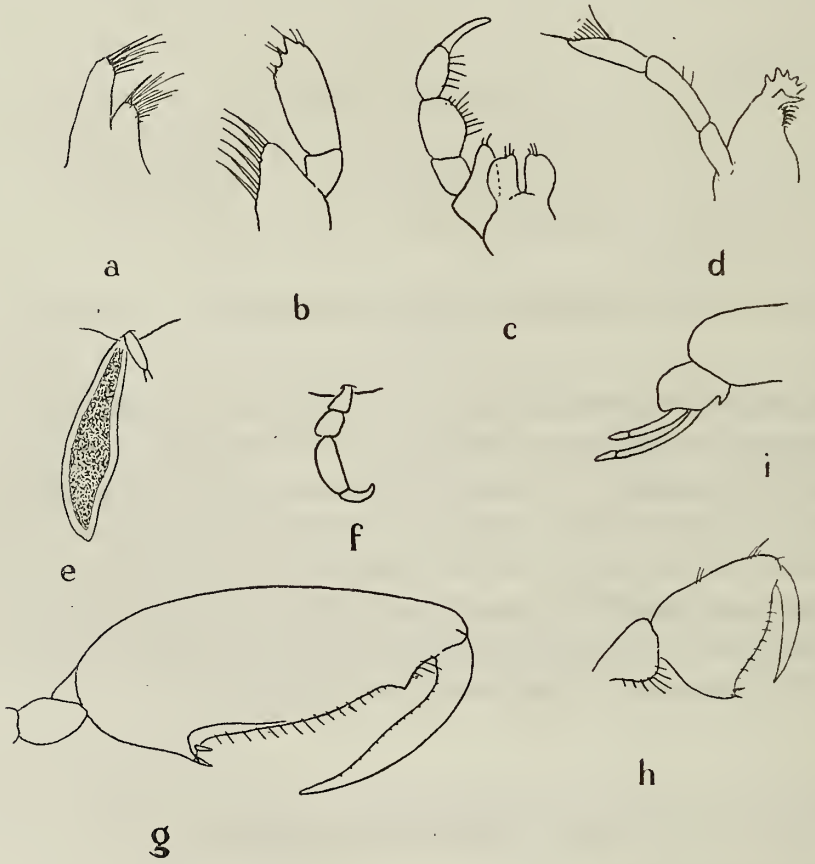

Fig. 63.—*Aeginoides gaussi*, Schell. *a*, maxilla 2; *b*, maxilla 1; *c*, maxilliped; *d*, mandible; *e*, peraeopod 1, with branchia; *f*, peraeopod 3; *g*, gnathopod 2, ♀; *h*, gnathopod 1; *i*, lateral view of pleon with appendages.

curving spine above insertion of gnathopod 2, and a medio-dorsal straight upstanding spine on hind margin; on segment 3 two dorso-lateral forwardly-curving spines on hinder half of segment vertically above insertion of branchiae, and two dorso-lateral short tubercles on hind margin; on segment 4 two dorso-lateral blunt upstanding spines just in front of middle of segment (vertically above insertion of branchiae); on

segment 5 two dorso-lateral short blunt tubercles vertically above insertion of 3rd peraeopods.

Head plus *peraeon* segment 1 a trifle shorter than segment 2. Forehead rounded. *Eyes* subrotund.

Pleon with 2 pairs of 2-jointed appendages, the 2nd joints being much shorter than the 1st joints, upper margins of both appendages very minutely setulose. *Branchiae* on segments 3 and 4 elongate ovate. *Oostegites* feebly setulose.

Antenna 1 slender and elongate, 1st joint moderately stout, 2nd twice 1st, 3rd a little longer than 1st, flagellum in ♂ 13-jointed, in ♀ 19-jointed, 1st joint longest. Antenna 2 without long setae (Ruderhaare), flagellum in ♂ 5-jointed, in ♀ 8-jointed. *Mouth-parts* as in *Caprellina*. Mandible with palp 3-jointed, 3rd joint with apical row of setae; spine-row present; molar absent. Maxilla 1 with 6 spine-setae. Maxilliped with outer plate small, only slightly extending beyond inner plate, 2nd joint of palp ovate. *Gnathopod* 1, 6th joint broadly triangular, palm slightly oblique. Gnathopod 2 inserted anteriorly, 2nd joint elongate, slender, 6th joint elongate ovate, palm very oblique, well defined, setulose, a slight angular projection near the hinge in ♂, stronger in ♀. *Peraeopod* 1 reduced to a mere rudiment with 2 apical setules. Peraeopod 2 completely obsolete. Peraeopod 3 4-jointed, the end joint forming a curved claw. Peraeopods 4 and 5 broken off in both ♂ and ♀.

Remarks.—There can be little doubt that the ♂ and the ♀ are conspecific. The species is evidently of large size and the ♂ is probably not fully grown. The hand of gnathopod 2 in a fully grown ♂ would probably show greater differences from that of the ♀. Further, they are clearly referable to Schellenberg's species, though I can find no trace of any lamina or projection representing the 2nd peraeopod on segment 4. The "Gauss" specimens were smaller and not obviously either ♂ or ♀.

Schellenberg mentions that there is a small specimen from McMurdo Sound in the Berlin Museum. It seems probable that this specimen was collected by the "Discovery," and was perhaps included among the *Leptostraca* which were sent to Dr. Thiele in Berlin for study.

Distribution.—65° 59′ S., 89° 33′ E., 350 metres.

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APPENDIX I.

NATIONAL ANTARCTIC EXPEDITION ("DISCOVERY"), 1901–1904.

The following specimens were obtained by the "Discovery" under the command of the late Capt. R. F. Scott, R.N. They were not submitted apparently to Walker or Miss Stewart (except certain of the *Cyllopus* specimens) and supplement the reports of these authors (1907 and 1913 respectively).

Vibilia antarctica, Stebb.

Walker, 1907, p. 6 (*propinqua*, non Stebb.), *supra*, p. 404.

Occurrence.—1. Sta. 45° S., 40° 57′ E. 22.x.01. 7 ♂♂ 8–10 mm., 10 ♀♀ 6–10 mm. 2. Sta. 45° 08′ S., 44° 47′ E. 23.x.01. 2 ♂♂ 10–11 mm., 7 ♀♀ 9–10 mm. 3. Sta. 46° 38½′ S., 93° 27′ E. 3.xi.01. 2 ♂♂ 9 mm., 3 ♀♀ 8–10 mm. 4. Sta. 52° 16′ S., 131° 36′ E. 12.xi.01. 1 ♀ 9 mm.

Vibilia armata, Bov.

Supra, p. 404.

Occurrence.—46° 38½′ S., 93° 27′ E. 3.xi.01. 1 ♂ 6 mm., 2 ♀♀ 4 mm.

Hyperiella dilatata, Stebb.

Supra, p. 413.

Occurrence.—Sta. Winter Harbour, May 6th, 1903. 1 juv. ♂ 5 mm., 1 ♀ 4 mm.

Cyllopus magellanicus, Dana.

Supra, p. 408.

I have examined 11 specimens, specially forwarded at my request by the British Museum, labelled *magellanicus*, Dana, by Walker. The details are as follows:

Occurrence.—1. Sta. ? 20.xi.01. (2 tubes.) 3 ♂♂ 11–12 mm. (one already dismembered). 2. Sta. 51° 56′ S., 170° 03′ E. 26.xii.01. 6 ♂♂ 9–10 mm. 3. Sta. 54° 01¼′ S., 170° 49′ E. 27.xii.01. 1 juv. 6 mm. 4. Sta. 63° 04′ S., 175° 43′ E. 1.i.02. 1 ♂ 12 mm.

In addition to these specimens, there were 4 tubes included in the "Terra Nova" collection as forwarded to me by Dr. Chilton.

5. Sta. 38° 59′ S., 25° 54′ E. 17.x.01. 3 ♂♂ 6–8 mm. 6. Sta. 45° S., 40° 57′ E. 22.x.01. 8 p.m. 1 ♂ 11 mm., 5 ♀♀ 10–11 mm., 4 immature 5·5–8 mm. 7. Sta. 46° 38½′ S., 93° 27′ E. 3.xi.01. 1 ♂ 8 mm., 1 ♀ 10 mm. 8. Sta. 48° 44½′ S., 100° 16½′ E. 5.xi.01. 1 ♂ 11 mm. (end of pleon missing).

APPENDIX II.

BRITISH ANTARCTIC EXPEDITION, 1907–1909.

The following records of the Amphipods captured during the course of the British Antarctic Expedition, 1907–1909 ("Nimrod"), under the command of the late Sir E. E. Shackleton, can be usefully included as an appendix to the report on the "Terra Nova" Amphipods, as they were collected in the same locality, viz. McMurdo Sound, where the latter ship wintered.

The collection was placed first in the hands of the late T. V. Hodgson, who handed them over to Dr. Chilton. Remarks on some of the species appeared in Chilton's report on the "Scotia" collection (1912), but no complete list was given. Dr. Chilton forwarded me his MSS. report, and the specimens have been independently examined by myself.

Aristias antarcticus, Wlkr.

Supra, p. 324.

Occurrence.—Bay [i.e. McMurdo Bay], 7–20 fathoms. May 1908. 1 juv. 5·5 mm.

Tryphosa adarei, Wlkr.

Supra, p. 326.

Occurrence.—Cape Royds, 60–80 fathoms. 20.viii.08. 1 immature 13 mm.

Orchomenella pinguides, Wlkr.

Supra, p. 327.

Occurrence.—1. McMurdo Bay, 7–20 fathoms. May 1908. Many specimens, labelled "Red Amphipods." 2. Ditto. Another lot. 3. McMurdo Bay. Seal hole. 4.v.08. Many specimens.

Remarks.—Some of the specimens preserved in formalin have red eyes, and the body still retains a faint pinkish tinge.

Further specimens of this species, identified by Dr. Chilton, are recorded in Waite's report on the Fishes (1911, Brit. Ant. Exp. 1907–1909, vol. 2) as being found in the gill-cavities of *Trematomus bernacchii* and *hansoni;* not as parasites but probably feeding on the dead fish.

Orchomenella franklini, Wlkr.

Walker, 1903, p. 47, pl. 8, figs. 31–36, and 1907, p. 13; Stebbing, 1906, p. 721.

Occurrence.—McMurdo Bay, 7–20 fathoms. May and June 1908. Several specimens, including ovigerous ♀♀, 5 mm.

Orchomenopsis chilensis (Hell.), forma *rossi*, Wlkr.

Supra, p. 327.

Occurrence.—McMurdo Bay, 7–20 fathoms. April and May 1908. A large number of specimens.

Remarks.—There is no doubt that this is the commonest Amphipod in this region (see Walker, 1907, p. 14).

Heterophoxus videns, Brnrd.

Supra, p. 334.

Occurrence.—Bay, 7–20 fathoms. June 1908. Several ♂♂ and ♀♀.

Remarks.—I have above given my reasons for regarding this form as distinct from both *Harpinia obtusifrons*, Stebb., and *Pontharpinia uncinata*, Chevr.

Leucothoe spinicarpa (Abildg.).

Supra, p. 338.

Occurrence.—Cape Royds. Chilton's label says June 1908, but his MSS. notes give August 1908, 30–80 fathoms. 4 ♂♂ 13–16 mm.

Gnathiphimedia pacifica (Stebb.).

Supra, p. 353.

Occurrence.—Cape Royds, 60–80 fathoms. 20.viii.08. 2 ovigerous ♀♀ 17 and 19 mm., 1 juv. 13 mm.

Remarks.—The original label, as transcribed in Dr. Chilton's MSS., stated that the colour was red.

Oediceroides newnesi (Wlkr.).

Walker, 1903, p. 53, pl. 9, figs. 62–66, pl. 10, figs. 67, 68, and 1907, p. 22; Schellenberg, 1926, p. 339.

Occurrence.—Bay, 7–20 fathoms. May 1908. 7 specimens 7–8 mm., including 1 ovigerous ♀ 5 mm.

Remarks.—Eyes visible in some specimens. Walker (1903) described the palm of gnathopod 2 as shorter than the rest of the hind margin; Schellenberg says it is $\frac{2}{3}$. In these specimens it is not always shorter than the hind margin. Also the 2nd joint of gnathopod 2 is not always longer than the rest of the limb; it is not so in the ovigerous ♀.

Distribution.—Cape Adare; McMurdo Sound; "Gauss" winter quarters.

Epimeria robusta, Brnrd.

Supra, p. 375.

Occurrence.—Cape Royds, 60–80 fathoms. 20.viii.08. 1 ♂ 22 mm.

Eusirus antarcticus, Thoms.

Supra, p. 384.

Occurrence.—Cape Royds, 60–80 fathoms. 20.viii.08. 2 immature 9–10 mm.

Paramoera walkeri (Stebb.).

Supra, p. 388.

Occurrence.—Bay, 7–20 fathoms. June 1908. 6 ♂♂ 10–15 mm.

Polycheria antarctica (Stebb.).

Supra, p. 390.

Occurrence.—Cape Royds, 60–80 fathoms. 20.viii.08. 1 specimen.

Haplocheira barbimanus (Thoms.).

Supra, p. 391.

Occurrence.—Bay, 7–20 fathoms. May and June 1908. 7 ovigerous ♀♀ 7–10 mm.

INDEX.

[*Synonyms are indicated by italics.*]

Acanthonotozomatidae, 345.
Acanthonotozomella, 346.
adarei, Tryphosa, 326, 448.
Aeginoides, 441.
aequabilis, Liljeborgia, 364.
ambobus, Leptocotis, 435.
Ampelisca, 329.
Ampeliscidae, 329.
Amphilochidae, 337.
Amphithyrus, 438.
anaticauda, Syrrhoites, 367.
Anchiphimedia, 357.
Anchylomera, 425.
Anchylomeridae, 424.
Andaniotes, 328.
anguipes, Ischyrocerus, 393.
anomala, Paralanceola, 398.
antarctica, Hirondellea, 319.
antarctica, Hyperia, 411.
antarctica, Hyperiella, 414.
,, Kerguelenia, 318.
,, Melphidippa, 383.
,, Polycheria, 390, 450.
,, Scina, 401.
,, Seba, 339.
,, Vibilia, 404, 447.
antarcticus, Aristias, 324, 448.
antarcticus, *Atylus*, 388.
,, Cyllopus, 409.
antarcticus, Eusirus, 384, 450.
antarcticus, Paramoera, 388.
antarcticus, *Proboliella*, 339.
antennarius, Simorhynchotus, 433.
Apherusa, 369.
Archaeoscinidae, 394.
Aristias, 324.
armata, Eupronoe, 427.
,, Vibilia, 404, 447.
armatum, Rhabdosoma, 436.
armatus, Cyllopus, 408.
atlantica, Phronima, 422.
atolli, Polycheria, 390.
Atylidae, 382.
Atyloides, 387.
australis, Parathemisto, 421.
,, Protophoxus, 335.

bajensis, Lycaea, 431.
barbimanus, Haplocheira, 391, 450.
bassi, Phoxocephalus, 330.
bassi, ,, , 331.
batei, Cyllopus, 408.
Bathymedon, 365.
bidens, Paracyclocaris, 321.
bispinosus, Amphithyrus, 438.
blossevillei, Anchylomera, 425.
boecki, Tryphana, 428.
bonellii, Corophium, 393.
borealis, Scina, 401.
bouvieri, Eusirus, 384.
Brachyscelidae, 432.
Brachyscelus, 432.
brachyteles, Rhabdosoma, 436.
brevicaudatum, Rhabdosoma, 436.
brevispinosa, Iphimediella, 351.

Calamorhynchus, 434.
calceolata, Paramoera, 388.
Calliopiidae, 369.
calmani, Oediceroides, 366.
campbelli, Parapronoë, 427.
capillatus, Trichophoxus, 336.
Caprella, 440.
Caprellidae, 440.
CAPRELLIDEA, 440.
Caprellina, 440.
Caprellinoides, 440.
capucinus, Hyperoche, 416.
challengeri, Streetsia, 435.
Cheirimedon, 326.
chilensis, Orchomenopsis, 327, 449.
Chosroes, 369.

chuni, Vibilia, 405.
clausi, Lanceola, 397.
,, Oxycephalus, 433.
clausii, Paratyphis, 429.
clypeata, Paraphronima, 409.
Corophiidae, 393.
Corophium, 393.
corpulentus, Andaniotes, 328.
crassicornis, Scina, 401.
crassipes, Paraphronima, 409.
crassum, Tetradeion, 329.
crusculum, Brachyscelus, 432.
curvidactyla, Scina, 401.
cyclogena, Iphimediella, 349.
Cyllopodidae, 402.
Cyllopus, 405.

danae, Cyllopus, 408.
,, Thyropus, 437.
Dexaminidae, 389.
dilatata, Hyperiella, 413, 447.
distichon, Eurystheus, 391.
dorsalis, Anchiphimedia, 357.
Dorycephalus, 434.
dubia, Liljeborgia, 365.
dubius, Platyscelus, 437.

echinata, Iphimedia, 361.
Echiniphimedia, 358.
edwardsi, Lycaeopsis, 425.
elongata, Phronimella, 423.
Epimeria, 372.
Epimeriella, 377.
equilibra, Caprella, 440.
Euiulopis, 418.
Eumimonectidae, 394.
Euprimno, 424.
Eupronoë, 426.
Eurystheus, 391.
Eusiridae, 384.
Eusiropsis, 387.
Eusirus, 384.
Euthemisto, 419.
Eutyphis, 437.

fabrei, Hyperia, 410.
falcata, Jassa, 392.
fascicularis, Regalia, 371.
felina, Lanceola, 397.
fisscauda, Paradexamine, 389.
forcipatus, Tetrathyrus, 439.
fougneri, Cheirimedon, 326.
franklini, Orchomenella, 448.

galba, Hyperia, 411.
GAMMARIDEA, 318.
gaudichaudii, Hyperia, 411.
gaudichaudii, Parathemisto, 420.
gaussi, Aeginoides, 442.
glaber, Amphithyrus, 438.
Gnathiphimedia, 352.
gracilipes, Parathemisto, 421.
gracilis, Paralycaea, 427.
Haplocheira, 391.
Harpinia, 334.
haswelli, Liljeborgia, 365.
hemicryptops, Ampelisca, 329.
Hemityphis, 437.
Heterophoxus, 333.
Hippomedon, 325.
Hirondellea, 319.
hodgsoni, Echiniphimedia, 359.
hookeri, Cyllopus, 408.
hydroccphala, Hyperia, 410.
Hyperia, 410.
Hyperiella, 413.
Hyperiidae, 410.
HYPERIIDEA, 394.
Hyperiidea Gammaroidea, 394.
,, Genuina, 409.
Hyperioides, 414.
Hyperoche, 415.

incerta, Podoprionides, 321.
incisus, Chosroes, 369.
,, Hippomedon, 325.
inermis, Epimeria, 374.
inermis, Epimeria, 375.
inscripta, Eupronoë, 426.
intermedia, Eupronoë, 427.
intermedia, Streetsia, 435.
Iphimedia, 348, 355, 359.
Iphimediella, 348.
Iphimediella, 353.
Ischyrocerus, 393.
isopodops, Prolaphystius, 342.
Iulopis, 418.

Jassa, 392.
Jassidae, 392.

kergueleni, Tryphosa, 327.
Kerguelenia, 318.

Lafystiidae, 342.
Lanceola, 397.
Lanceolidae, 397.
Laphystiopsidae, 342.
Laphystiopsis, 342.
laticarpus, Eusirus, 384.
latissima, Hyperia, 410.
Leptamphopus, 369.

Leptocotis, 434.
Leucothoe, 338.
Leucothoidae, 338.
levis, Apherusa, 369.
Liljeborgia, 364.
Liljeborgiidae, 364.
lindströmi, Leptocotis, 435.
longicollis, Caprellina, 440.
longimanus, Iscyrocerus anguipes var., 393.
longimanus, *Wyvillea*, 393.
longipes, Hyperioides, 414.
,, Maxilliphimedia, 355.
loveni, *Euiulopis*, 418.
loveni, Iulopis, 418.
lucasii, Cyllopus, 409.
luetkenides, Hyperoche, 416.
luzoni, Hyperia, 410.
Lycaea, 428.
Lycaeidae, 428.
Lycaeopsidae, 425.
Lycaeopsis, 425.
Lysianassidae, 318.

macrocephala, Hyperia, 410.
macrodonta, Epimeria, 372.
macronyx, Epimeriella, 378.
,, Hyperia, 412.
,, Synopioides, 363.
macropa, Primno, 424.
macrophthalma, Hyperia, 410.
macropis, *Vibilia*, 408.
macropus, *Euprimno*, 424.
macrura, Melphidippa, 383.
maculata, Eupronoë, 426.
magellanicus, Cyllopus, 408, 447.
malmi, Tryphana, 428.
mandibularis, Gnathiphimedia, 352.
margueritei, Iphimediella, 348.
Maxilliphimedia, 355.
Melphidippa, 383.
Melphidippidae, 383.
Metopidae, 339.
microcarpus, Oediceroides, 366.
microdentata, *Iphimedia*, 348.
microps, Eusirus, 385.
Mimonectidae, 394.
minuta, Eupronoë, 426.
murrayi, Tryphosa, 326.

nasuta, Lycaea, 430.
neozelanicus, Bathymedon, 365.
newnesi, Oediceroides, 449.
nodosa, Echiniphimedia, 361.
Nototropis, 382.
novaezealandiae, Leptamphopus, 369.
novaezealandiae, Phronima, 422.

oatesi, Acanthonotozomella, 346.
obesa, Waldeckia, 323.
obtusifrons, *Harpinia*, 334.
Oediceroides, 366.
Oedicerotidae, 365.
Orchomenella, 327.
Orchomenopsis, 327.
ornata, Stenothoe, 341.
Oxycephalidae, 432.
Oxycephalus, 433.

pacifica, Eupronoë, 426.
pacifica, Gnathiphimedia, 353, 449.
,, Paradexamine, 389.
,, Phronima, 423.
Paracyclocaris, 321.
Paradexamine, 389.
Parahyperia, 414.
Paralanceola, 398.
Paralycaea, 427.
Paramoera, 388.
Paramphithoidae, 372.
Paraphoxus, 332.
Paraphronima, 409.
Paraphronimidae, 409.
Parapronoë, 427.
Parascelidae, 436.
Parascina, 395.
Parathemisto, 419.
Paratyphis, 438.
Pardaliscidae, 363.
parvus, Paratyphis, 439.
pauli, Lycaea, 430.
pauli, Lycaeopsis, 425.
pellucidus, Calamorhynchus, 434.
Peltopes, 337.
perdentatus, Eusirus, 386.
perlatus, Proboloides, 339.
Phorcorrhaphis, 425.
Photidae, 391.
Phoxocephalidae, 330.
Phoxocephalus, 330.
Phronima, 422.
Phronimella, 423.
Phronimidae, 422.
Phrosina, 424.
Phrosinidae, 424.
pinguides, Orchomenella, 327, 448.
piscator, Oxycephalus, 433.
Platyscelidae, 437.
Platyscelus, 437.
Podoprionides, 321.
Polycheria, 390.
Pontogeneiidae, 387.
porcellus, Streetsia, 435.
Primno, 424.

Proboliella, 339.
Proboloides, 339.
productus, Peltopes, 338.
Prolaphystius, 342.
promontorii, Hyperia, 411.
Pronoidae, 426.
propinqua, Vibilia, 404.
propinqua, Vibilia, 404.
propinquus, Eusirus, 384.
Protophoxus, 335.
pulchellus, Tetrathyrus, 439.
puncticulata, Epimeria, 376.
Pygmaeidae, 394.
pyripes, Paraphoxus, 332.
,, Vibilia, 405.

quadridens, Atyloides, 387.
rapacoides, Brachyscelus, 432.
rapax, Hemityphis, 437.
reductus, Nototropis, 382.
Regalia, 370.
regium, Phoxocephalus, 331.
Rhabdosoma, 436.
rigida, Iphimediella, 351.
riisei, Eusiropsis, 387.
robusta, Epimeria, 375, 449.
,, Vibilia, 403.
rossi, Orchomenopsis chilensis f., 327, 449.

sancti-josephi, Tetrathyrus, 439.
scabrosa, Epimeriella, 378.
scheeleana, Synopia, 367.
schizogeneios, Hyperia, 411.
Scina, 400.
Scinidae, 400.
scotti, Echiniphimedia, 360.
Seba, 339.
Sebidae, 339.
sedentaria, Phronima, 422.
semilunata, Phrosina, 424.
serrata, Vibilia, 408.
serraticauda, Paramoera, 388.
serratulus, Platyscelus, 437.
serratus, Platyscelus, 437.
setosa, Parascina, 395.
sexdentata, Iphimediella, 353.
sibaginis, Hyperioides, 414.
similis, Epimeria macrodonta f., 373.
Simorhynchotus, 433.
simplex, Andaniotes, 328.
solitaria, Phronima atlantica var., 423.
sphaeroma, Thyropus, 437.
spinicarpa, Leucothoe, 338, 449.
spinifera, Leptocotis, 435.
spinosa, Caprellinoides, 441.
spinosus, Paratyphis, 439.
splendidus, Eusirus, 386.
stebbingi, Simorhynchotus, 433.
stebbingi, Vibilia, 403.
Stegocephalidae, 328.
Stegocephaloides, 328.
Stenothoe, 341.
Stenothoidae, 341.
Streetsia, 435.
Synopia, 367.
Synopiidae, 367.
Synopioides, 363.
Syrrhoites, 367.

tenuimanus, Hemityphis, 437.
tenuirostris, Leptocotis, 435.
Tetradeion, 329.
Tetrathyrus, 439.
Tetronychia, 319.
Themisto, 419.
themistoides, Lycaeopsis, 425.
Thyropidae, 436.
Thyropus, 437.
Tironidae, 367.
Trichophoxus, 336.
Tryphana, 428.
Tryphanidae, 428.
Tryphosa, 326.
typica, Proboloides, 339.

ultramarina, Synopia, 367.

vanhöffeni, Stegocephaloides, 328.
viatrix, Vibilia, 403.
Vibilia, 403.
Vibiliidae, 402.
videns, Heterophoxus, 334, 449.
vincentii, Lycaea, 429.
vosseleri, Hyperia, 410.

Waldeckia, 323.
walkeri, Epimeriella, 380.
,, Paramoera, 388, 450.
whitei, Rhabdosoma, 436.
Wyvillea, 393.

Xiphocephalus, 436.

zamboangae, Lycaeopsis, 426.
zschauii, Anonyx, 323.
zschauii, Waldeckia, 323.

PRINTED IN GREAT BRITAIN BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

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